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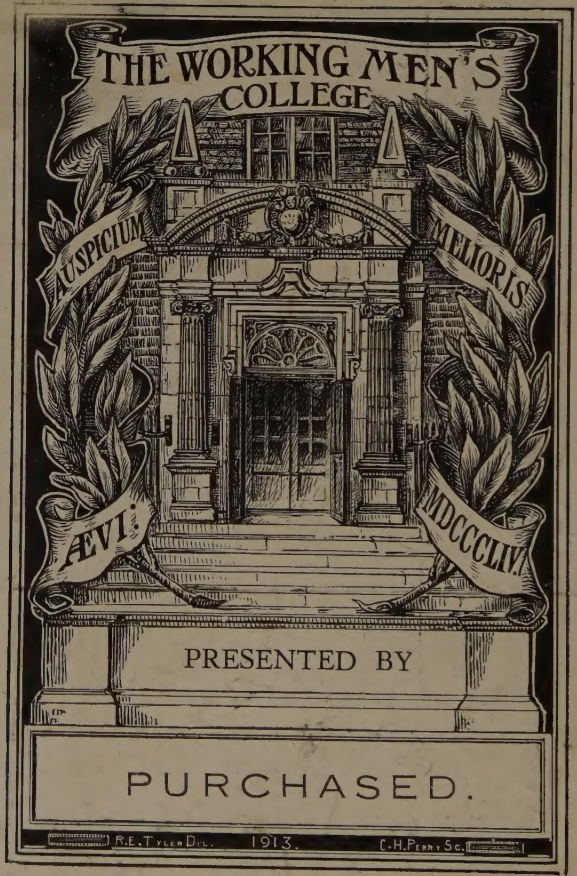
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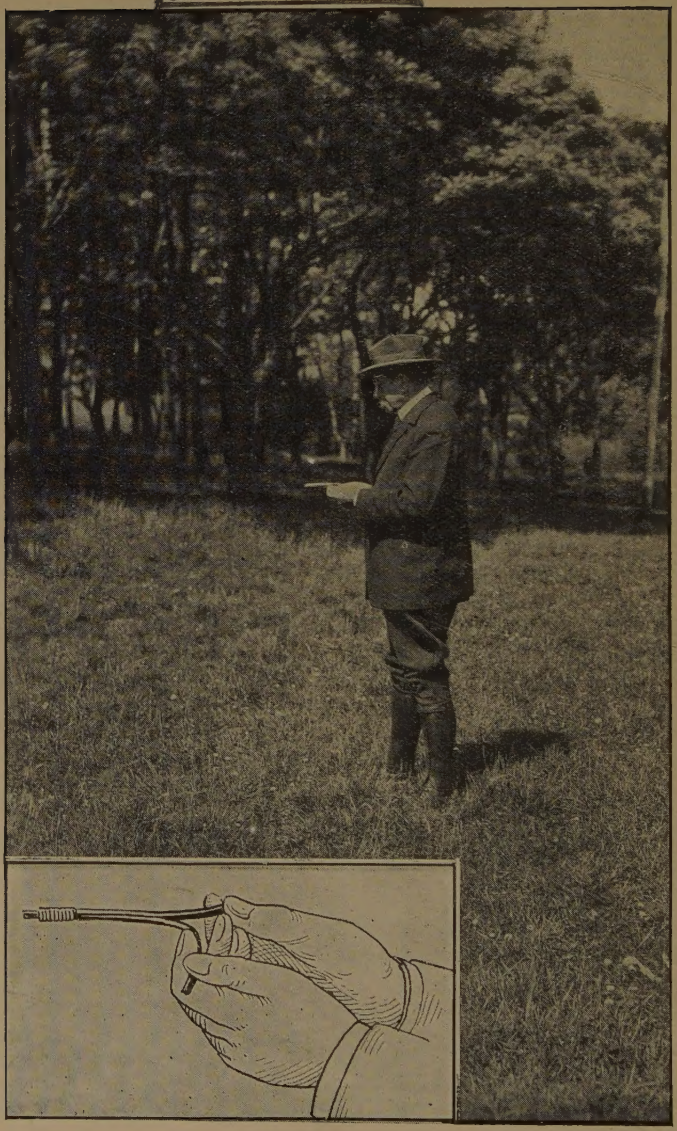

PLATE I.—PROSPECTING WITH THE ROD. INITIAL POSITION

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THE MODERN DOWSER

A GUIDE TO THE USE OF THE DIVINING ROD AND PENDULUM

BY
LE VICOMTE HENRY DE FRANCE

TRANSLATED BY
A. H. BELL

LONDON
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1930

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BIOGRAPHICAL NOTE

LE VICOMTE HENRY DE FRANCE, the author of this little book, comes of an old French aristocratic family, which has been well known in the north of France for six hundred years. He was born at Abbeville in 1872, and in due course became Licentiate in History and Geography at the University of Paris. He has devoted most of his life to political and economic pursuits and is a keen fisherman, having been at one time President of the Casting Club of France, which he founded in conjunction with the late Prince Peter d'Arenberg. He has also been president of the Syndicate of the Journalists of Fishing and Hunting, etc.

He became interested in dowsing about seven years ago, as a result of research made for the review *Les Etudes* on that subject, specially as regards its practice by the numerous priest-dowsers in France.

As a dowser himself he has been instrumental in the driving of numerous wells, many of them of great depth. He has wide knowledge of geology and mineralogy, and in this connection has carried out very interesting researches in various parts of France. He has made a special study of the question of petroleum and has detected its presence in several places, but not in sufficient quantity for industrial exploitation. He has proved the efficacy of the rod

as an indicator of the presence of precious metals by discovering quite recently in the devastated area an important cache of silver, which had been buried during the war.

In numerous other cases he has been able to ascertain that buried articles of silver had been removed. He has frequently been requested to discover underground sally-ports and foundations of feudal castles and abbeys and has often been successful in doing so.

He has attended numerous conferences on the subject of dowsing, and early in 1930 started a course of instruction at Abbeville in the Art of Dowsing, probably the first course ever held in this subject.

He is now president of the *Association des Amis de la Radiesthésie*, which is an International Union of Dowsers recently founded by M. l'Abbé Bouly, with its headquarters at 91 Rue de l'Hôpital Militaire, Lille.

INTRODUCTION

IT is well known that there are people who are able with the help of a hazel rod to indicate places where subterranean water can with certainty be found.

Until quite lately this remarkable and unexplained fact was regarded as a curiosity of little interest ; but since the war this question has become the object of serious study both in France and neighbouring countries.

It was soon realised that there is nothing exceptional or marvellous in the dowser's art ; that it can be acquired like any other art, though a certain predisposition is desirable just as it is for painting or music.

The dowser's art is subject to laws and can be learnt by instruction. It is now known that it depends on scientific theories similar to those which account for wireless telegraphy, and with this knowledge the traditional sphere of the divining rod was bound to acquire a vast and rapid extension. Research has disclosed that the rod was used by miners in ancient times even as now ; it represents for the geologist what the telescope is for the astronomer, or the microscope for the biologist.

Not only can minerals and metals be traced by its aid, but also faults and cavities, and hence the archaeologist has found for it a use as unexpected as it has been fruitful in result.

Quite lately a still more remarkable application has been successfully attempted. The rod is now used to examine the physical condition and to diagnose the diseases of plants, animals and human beings. Recent experiments carried out under strict control leave no doubt on this point.

The results of these discoveries can be observed in the most varied connections.

The art of using the rod and its fellow instrument, the pendulum, will become invaluable to an ever increasing number of people both from the practical as well as from the scientific point of view. Farmers, architects, archaeologists, engineers, officers, geologists, doctors, veterinary surgeons, all have a use for it. I therefore consider that the publication of a small practical manual in which is given all essential information for the training of an operator in the use of the rod and the pendulum will be helpful to them.

After a short historical study I have stated the possible scientific explanations of the movements of these instruments. Being thus on common ground with the known sciences I find the path easier to follow and am better able to indicate a definite system to be pursued.

This system comprises a number of fundamental experiments with electric currents, which can be reproduced later with water, metals, ores, plants, animals and even man. The same methods are always used, requiring the application of the same laws.

These electrical experiments not only offer the great theoretical advantage of binding us to the

scientific point of departure, but they present—what is equally important—a sure and rapid method of training the operator and of affording him a simple means of directing his efforts and checking his results.

I offer here my most sincere thanks to those journals and reviews which during the past few years have been kind enough to print my articles on this subject. I am especially grateful to *Les Etudes*, *La Vie à la Campagne*, *Le Chasseur Français*, *L'Acclimation*, *Chasse-Péche-Elevage*, *Le Petit Patriote*, etc.

I also thank those whose advice and information have been so useful, notably MM. the Abbés Bouly, Mermet, Ferran, the Reverend Father Poisson, Friar Padey, MM. Mager, Viré, Mathieu, Darder Pericas, Colonel Moreau ; and, for the geological part, MM. Demarty and de Bussac.

H. F.

ARRY (SOMME)
March, 1929

CHAPTER I

HISTORY OF THE ROD AND THE PENDULUM

THE art of the divining rod certainly goes back to the most remote antiquity, but we find no documentary reference to it previous to its condemnation by Luther in 1518.[1] We find it mentioned in the writings of Basile Valentin, of Agricola, and of a certain number of German authors of the sixteenth century, whose names can be found in the important bibliography at the end of *The Divining Rod.*

The rod was certainly used in the Middle Ages in Central Europe for discovering mines. Documents with which a Russian scientist, Mr. Th. Vinogradoff, has provided us, show that it was employed for the same purpose in a large part of Russia, and that in Asiatic Russia the practice of the rod was connected with the ancient rites of Shamanism. The same is equally true of Africa and Malaya ; in the stories of travellers we read of an almost universal use of instruments similar to our hazel rods, always more or less in connection with religious or superstitious practices.

The first appearance the rod makes in our history, and that in a manner which till our own time was

[1] *The Divining Rod*, by Sir William Barrett and Theodore Besterman, Methuen, 1926, p. 7.

unique, is in the hands of the Baron and Baroness de Beausoleil, two veritable heroes of romance.

Jean du Chastelet, Baron de Beausoleil and d'Auffenbach, was born in Brabant about the year 1578. In 1601 he married Martine de Bertereau, of a family of Touraine. Both of them went in for prospecting for mines and their travels extended throughout Europe. Jean de Beausoleil was soon entrusted with important work by the Emperor of Germany, who made him Commissary General of mines in Hungary. The Archduke Leopold and the Duke of Bavaria bestowed on him ranks of equal importance ; finally d'Effiat, in the name of the King of France, gave him a commission which was registered in several parliaments in 1627. Shortly after the Beausoleils met with an extraordinary adventure. They were prospecting in the neighbourhood of Morlaix, when La Touche-Grippée, provincial provost of Brittany, suspecting them of magic and sorcery, had their house searched during their absence and confiscated 'rings and jewels belonging to the Baroness, gold and silver given by the State, mineral specimens, reports, papers, notes about places where they had found minerals, tests they had made, instruments for discovering mines'.

In spite of all their efforts the Beausoleils did not succeed in recovering their confiscated property. Their papers, however (according to M. Albert Descoqs, who has studied this singular affair), escaped destruction. After numerous vicissitudes they fell during the eighteenth century into the hands

of Romé de Lisle, who, with Haüy, was the inventor of crystallography. It is regrettable that this scientist did not realise the connection existing between the new science and the art in which the Beausoleils had attained so much proficiency. However that may be, he passed on the manuscript to Gobet, who published it in his *Anciens Minéralogistes du Royaume de France*. This manuscript contained a list of more than sixty places in Brittany, with, in many cases, the most precise information on the mines to be found there. It is a work of real importance which would be worthy of careful verification by the dowsers and prospectors of to-day. The Baroness de Beausoleil produced in 1630 *la Véritable déclaration des mines au royaume de France,* followed in 1640 by *La Restitution de Pluton*. This latter work was preceded by a sonnet addressed to Richelieu. It is not exactly known what happened then. At all events the Baron was imprisoned in the Bastille and the Baroness at Vincennes, and from that moment nothing more was heard of them.

There is no exact information about the apparatus used by the Baron and Baroness de Beausoleil, but it is known that they used rods partly composed of the metals they were seeking ; hence they were undoubtedly employing the system of 'samples' (*témoins*), that most generally used to-day.

They were then the authentic founders of our art, a title which they well deserve not only on account of their technical skill, which was great, but on account of their extensive experience in mineral and metallurgic affairs, whereby they set an

example which might well be followed. Unfortunately they had no imitators.

A Jesuit scientist, Father Kircher, however, interested himself in these questions. In his books *Magnes* (1641), *Mundus subterraneus* (1678), he remarks that the term *Virgula Divinatoria*, divining rod, ought to be replaced by the more precise and less magical *Virgula aurifera* or *metalloscopia*. He had analysed with exactness the movements of the dowser's hands and had striven to detect their cause ; moreover, he is one of the first to mention the discovery of subterranean streams by means of the rod.

Towards the close of the seventeenth century a sensational event occurred which invested our art with great publicity.

On July 5, 1692, a wine merchant and his wife were assassinated at Lyons. A neighbour brought to the spot a peasant of Dauphiné called Jacques Aymar, saying that he would be able to discover the criminals with his divining rod. From this point we enter the realm of the fantastic. However, the contemporary accounts are still extant, ample in bulk and worthy of credence.[1] Aymar got his rod to turn over the victims, and started on the track of the murderers, accompanied by a crowd prompted by curiosity rather than by conviction. On leaving Lyons he entered a garden where were two children : his rod turned over one of them, and both confessed that in the absence of their parents three evil-

[1] Louis Figuier : *Les Mystères de la Science*, p. 564. G. Lenôtre : *Aventures extraordinaires des Sourciers* 'Lectures pour tous,' September 19, 1913.

looking men had come in and called for a bottle of wine. The magistrates of Lyons began to have confidence in Aymar and provided him with an escort of five archers. An extraordinary and fascinating pursuit then began—sometimes on land, sometimes on water. The rod indicated numerous inns in which it reacted over a multitude of glasses. Once the track was nearly lost in a soldiers' camp near Vienna, but it was picked up again and led our intrepid seekers into the middle of the fair at Beaucaire. Aymar went straight to the prison where the gates were opened to him and the prisoners revealed. . . . The rod turned over one of them, a little hunchback who had just been arrested for a trifling theft. He naturally protested his innocence with the utmost energy, but the sergeant of archers declared him a lawful prize and decided to take him back to Lyons. Aymar pursued the other criminals, whom, as he said, he traced to the Italian frontier. Meanwhile the archers were making their way by short stages to Lyons, stopping conscientiously at all the inns they had visited on their outward journey. . . . The hunchback was recognised everywhere : finally he confessed, was tried and executed.

This affair attained great publicity and Aymar became famous. He was summoned to Paris by the Prince de Condé, but at that place there happened that which befell another southerner, Alphonse Daudet's legendary drummer : he lost all his powers. History relates that he tried to supplement them by trickery, like a spiritualistic medium

of to-day. However that may be, he returned to the South. There he recovered his remarkable faculties and applied them with success to the service of the King in the terrible war with the Camisards.

Aymar's case was responsible for the flow of a lot of ink. The Abbé de Vallemont in his *Physique occulte* or *Traité de la Baguette divinatoire*, supported him, basing his views on the theories of Descartes then much in vogue. According to him there are corpuscules which cause the rod to move, and the latter can distinguish between matter of different kinds—aqueous, thievish, murderous, etc. In spite of these strange views the abbé's book had the great merit of being the first to describe the dowser's art in detail and with precision.

In the other camp we find Father Lebrun, Oratorian, sharply attacking in his *Histoire critique des pratiques superstitieuses*, the practice of seeking criminals by means of the rod. In his campaign he laid stress on an extremely interesting letter of the illustrious philosopher Malebranche, which is worth quoting : 'It is clear that material causes which have neither intelligence nor freedom always act in the same manner in the same environment, and for purely material reasons ; there are no circumstances other than material causes which determine their action ; it is known by experience and by reason that bodies have neither intelligence nor freedom, and that they only move when they are pushed, and that they cannot be pushed without clashing with and being compressed by the bodies surrounding them. Hence it is evident :

'(1) That the diviner's intention to find silver cannot determine the movement of the rod towards the silver and prevent its movement towards the water if it were truly influenced by a spring, for this intention in no way changes the material circumstances of the rod and the water.

'(2) A stolen article remains the same as before, and the crimes of the thief which do not change the body or change it only as much as does remorse for other crimes (for even supposing that remorse in troubling the conscience, changes the body, it is clear that remorse for having stolen a fowl must affect the conscience in the same way as remorse for having stolen a walking-stick), it is obvious that the rod cannot turn towards the thief or robber of the object sought without the influence of an intelligent cause.'

However that may be, it is certain that there were at that time dowsers who claimed to be able to track criminals. Malebranche wisely rejects the crime theory, but the fact remains that there have been dowsers who have been able to trace human beings.

We have, moreover, known a dowser who asserted that he could pick up the path of a hunted animal and distinguish it from cross tracks.

Following the same line of thought it is conceivable that the rod might solve the problem of the sense of direction in animals, but this is a question on which too little experience is available ; let us return to the beaten track.

The eighteenth century produced a genuine dowser, Barthélemy Bléton, like Aymar a native of

Dauphiné, who attained great celebrity. Attention was drawn to him by certain discoveries of springs, but he became famous as the 'subject' of Dr. Thouvenel, an important person, much esteemed at court and in the scientific world. He took his 'patient', as he called him, to the places best calculated to increase his reputation. He got him to find springs before the Queen, Marie Antoinette, and on the estates of some of the greatest lords of the kingdom. Bléton carried out some sensational experiments at the aqueduct of Auteuil, but in reality his performances in no way surpassed those of an average dowser of the present day, in fact they were not as good, for he was often mistaken in the matter of depth. He did not work with a forked rod like the majority of dowsers, but he used a straight rod balanced on his two index fingers. This method, described by us on page 24 below, gives results but seems to be less efficient than the ordinary method. Thouvenel published his experiences in 1781 under the title : *Mémoire physique et médicinal, montrant des rapports évidents entre les phénomènes de la baguette divinatoire, du magnétisme et de l'électricité.*

Dr. Thouvenel's idea was in our opinion correct : unfortunately in his day the theories of wireless telegraphy, induction and electro-magnetic waves were unknown. The doctor had observed that his 'patient' when standing on an insulated stool was unable to work his rod, an event unlikely to have occurred with a less docile subject. Now the celebrated physician Charles played a trick on Thouvenel

by breaking the insulation of the stool without his knowledge, and he published the results. The authoritative reports of Charles were instrumental in delaying for a long period the explanation on electrical grounds of the phenomena of the rod.

Some years before, in 1750, Diederick Wessel Linden, an English engineer of German extraction, had published in London, *Three letters on Mining and Smelting*, which were translated soon after into French. After speaking of the magnet, i.e. 'sample' (*témoin*), that is to say the piece of mineral similar to the object of search, the author adds : 'This Magnet is to be fixed to the Hazel Fork, and then tried upon the Places where the Vein is suspected to lie : and if there is any, by properly guiding, turning, conducting, etc. the Machine, the Effluvia will be caused to ascend as out of an electrical Body when electrified ; which will communicate such an Impulse or Motion to the Magnet, that the skilful Mineralogist may be able to frame his Judgment with sufficient Certainty'.

Linden adds the following advice which is still applicable : 'But this I must recommend, above all Things, that no one attempts to aspire to the Knowledge of the *quoddam indicans seu Divinatorium*, that is not perfectly well versed in Mineralogy and Metallurgy ; . . . but, if he is a Master of these, he may proceed to learn what I have just now been speaking of, by a rational, but not an ill-grounded Theory ; by a constant, but not a superficial Practice ; taking care that he plunge himself not into the Abyss of imaginary Hypothesis, with which this Science is

overwhelmed, and too many of its Followers are infatuated ; but let him be cautious in determining, and not hurried away by too early appearing Symptoms, but prudently and patiently wait till all promising ones concur, which he by Experience has found to be plain Indicants'.

It is much to be regretted that after such good advice Linden should not have considered it desirable to reveal his method. However, he does recommend us to join zinc to the metal carried as a 'sample'. Here we have, long before the era of Galvani and Volta the first idea of an electric current caused by metallic contact intended to increase the amplifying power of the 'sample'.

In 1798 Gerboin, Professor at the Faculty of Medicine of Strasbourg, having observed the movements of a ball fastened to the end of a string, which a child was playing with, invented the dowser's pendulum. For ten years he carried out his experiments and in 1808 he published the results. They all had to do with the movements of the pendulum above metallic substances.

The illustrious Chevreul took up his experiments, and in 1812 gave his opinion on them in his *Lettre à Ampère sur une classe particulière de mouvements musculaires*. He attributed all the movements of the pendulum to what we call the sub-conscious. According to him the movements of the rod are purely subjective, the dowser being their involuntary author. Until our own time this has remained the opinion of almost the whole scientific world and even of a certain number of dowsers, who though

convinced of their power to discover hidden objects attribute it to a psychic or metapsychic power. It is to be regretted that Chevreul did not carry his experiments further and strive to eliminate auto-suggestion.

Thus it is that the two celebrated scientists, Charles and Chevreul, have by their incomplete or hasty experiments caused the rejection of the rod as a scientific instrument—and, in consequence, have deprived us for more than a century of the great advantages to be derived from the use of this instrument.

During the nineteenth century the history of the rod records no outstanding event, save for the investigations of Count de Tristan and his nephew Baron de Morogues, based on what was then known of electricity. Of the same type was the work of Abbé Carrié in 1863, who was, moreover, the inventor of a disc instrument intended to improve the rod by providing a dial for recording the amplitude of the movements.

Abbé Carrié seems to have been the first of the priest dowsers. There had been about the middle of last century a country curé, Abbé Paramelle, who gained an extraordinary reputation as the discoverer of springs. He did not use a rod, but his successes were well known amongst his associates, who in trying to copy him naturally turned for assistance to the rod and the pendulum.

Amongst the contemporaries of Abbé Carrié must be mentioned Abbés Descosses and Guinebault, authors of pamphlets on the subject. In our own

time the number of priest dowsers has grown considerably, and we know of several who have not only acquired wide renown but have caused important progress in the art of the rod and the pendulum.

We will now describe the extremely important results which have been obtained during the last few years.

In 1913 M. Henri Mager, the well-known author of works on geography and hydrology, and M. Armand Viré, Director of the Laboratory of Subterranean Biology at the Muséum, arranged at a congress of experimental psychology to organise a competition of dowsers, which duly came to pass.

The tests consisted of searching for underground streams, cavities, pipe lines, buried metallic substances, metal plates in envelopes, etc. A number of competitors passed these tests with honour, some with brilliance.

The art of the rod then took a new turning. From that time onwards an ever increasing group of scientists began to take it seriously, and it is now being put into practice by well-educated men accustomed to methods of verification and check.

Further international competitions and meetings took place at Paris in 1923 and 1926, at Barcelona in 1927, at Algiers in 1928. Of late years foreign scientists of high standing have studied the problem of the rod theoretically and even practically : amongst them are Sir William Barrett, recently deceased, Professor at the University of Dublin ; M. Bosset, Professor at the University of Lausanne ; M. Darder Pericas, Professor at the Institute of Tarragona.

At the same time several important works on the subject have appeared :

Les Sourciers et leurs procédés, by Henri Mager, Paris (Dunod).

Le Traité complet des secrets de la baguette, by Friar Padey, Paris (Desforges, Girardot) ; *L'hydrologie*, by Landesque, Paris (Dunod) ; *The Divining Rod*, by Sir W. Barrett and Theodore Besterman, London (Methuen).

A striking feature of the dowser's art is the number of new regions now explored by operators with the rod and pendulum. In addition to the traditional use of the art for discovering water and mineral ores it is now employed for researches of a medical and biological nature.

Numerous are the methods employed by dowsers ; for instance there is that of M. Mager, based on the use of colours, a method which M. Bosset has applied to the pendulum. Then there is the method of Abbé Bouly, Curé of Hardelot (Pas-de-Calais), which consists primarily in observing the movements of the rod, at the instant it passes through the vertical plane occupied by the sun, the object sought, and the 'sample'.

The method of Abbé Mermet (a Frenchman born in Savoy), Curé de Saint-Prex, near Lausanne (Switzerland), depends on the positions of the hands for an estimate of distances and depths and includes a system of calculation adaptable to any unit selected.

Abbé Ferran, Curé de Saint Paul near Penne-du-Tarn (Tarn), is the originator of the system of adjustment of pendulums as regards weight and length,

a process analogous to tuning in on a wireless apparatus. He has also invented a method for electrifying the copper wire by means of which many dowsers calculate depths, and an arrangement for working with two 'samples'.

It is these methods of Abbés Bouly, Mermet and Ferran with which we are chiefly concerned in the following pages. In our opinion they afford several important advantages. Firstly, they can quite well be used conjointly, forming a complete and practical system. Secondly, they are easy to learn and to remember, and the apparatus required is as portable as it is cheap. Finally, they seem to harmonise with our knowledge of electricity and wireless telegraphy. To our mind they seem particularly suitable for beginners, who in using them will quickly obtain appreciable and encouraging results.

We consider that the art of the rod can be taught like any other art. For a long time it was looked upon as a kind of psychic gift grudgingly and irregularly bestowed ; but its history, of which we have just given a brief summary, as well as the investigations made during the last few years, have demonstrated in no uncertain fashion that the reverse is the case. Certain qualifications are clearly necessary, but there are few who cannot become passable operators with the rod and the pendulum.

The reason why this has not been recognised earlier is because the majority of dowsers concealed their methods or gave them a mysterious semblance,

and because those who provided explanations, like Vallemont, accompanied them too frequently with improbable theories and unaccountable practices.

We hope this is all done with. We have tested and verified the methods or rather the method which we are about to describe ; we hold that it represents a series of reasonable operations easily reproduced.

From the historical sketch we have given it will be gathered that in electricity rather than in unknown forces is to be found the source of the remarkable phenomena of the rod ; and so it is in reference to electricity that we base our system of instruction.

Before closing this sketch we would like to give an account of some of the feats performed by modern dowsers.

We will begin with Abbé Bouly, the first dowser of our acquaintance. The owners of a factory asked him one day if he could find water of a certain hydrometric quality. He took a bottle containing water of the quality desired, and putting his system into action discovered water at 150 metres. A boring was made and the forecast of the Abbé was found to be strictly accurate.

Abbé Bouly was instrumental in removing quantities of shells from fields which had been rendered unfit for cultivation by their presence—for this he was decorated with the *Mérite Agricole*. A General asked him by way of a joke : 'No doubt you can tell a German shell from an allied one !' 'I will do it to-morrow', answered the Curé of Hardelot, and he kept his word.

On another occasion one of the hospitals of Berck telephoned to him, asking for his assistance at a bad operation : ' It is a case of cancer in the breast', he was told, 'if the spinal column is not affected, the operation is possible'.

The rod did not budge, the surgeon operated and the woman recovered—a remarkable example of the two-fold trust of the priest and of the doctor, which recall the celebrated utterance of Ambroise Paré, 'I tended him, God healed him'.

In another case there was doubt about the part of the body in which an operation should be done. Abbé Bouly indicated a spot quite different to that which the surgeon had noted. An X-ray photo was taken to see which was right ; it proved the Curé of Hardelot to be correct.

We must quote one more case of Abbé Bouly's, one which was mentioned in all the papers in the north of France. Three horses died one after another in a large farm near Abbeville. The Curé on being summoned asked for a veterinary surgeon, and recognised amongst the animals' food the oats which had been the cause of the poisoning.

But there is more. 'M. le Curé', said the veterinary surgeon, 'told us that if we replaced the guilty oats by an antidote to the toxic products absorbed by the dead horses, the rod would turn as freely as in the presence of the oats. We proposed to try this experiment on sulphate of copper, iodide of potassium, arsenic and sulphate of quinine ; only the sulphate of copper caused the reaction of the rod. It seems to have efficacy as an antitoxin, but unfor-

tunately its own toxic properties prevent it being used as internal medicine for animals.'

We now come to the Abbé Mermet. Last summer we accompanied him to the country above Montreux where he had been asked to prospect for water for some châlets. To understand what follows it must be explained that the owners of the mountain châlets in this district know the exact yield of their taps, which flow without ceasing. Abbé Mermet went up to a châlet surrounded by a group of people ; he stopped, turned towards the owner and said : 'Allow me to estimate the yield of the tap which supplies you'. Everyone looked at the Curé of Saint-Prex with astonishment. He stretched out his arm, made a rapid calculation, and said confidently : 'Your tap gives 4 litres 5 decilitres per minute'. The owner, to the general surprise, had to admit that the Abbé was right to a decilitre.

Abbé Mermet also finds buried or hidden metals, and distinguishes them according to geometrical figures which they reveal.[1]

We have seen him make a complete diagnosis of a case of serious illness and even estimate the depth of the seat of trouble.

In an article by M. Armand Viré, on the searches he made during the war to discover the ancient subterranean refuges of Artois, we read : [2] 'At the furthest end of the gallery we felt another space

[1] *Le Pendule Révélateur*, by Abbé Mermet, Cognac. Paysan Printing Press.

[2] *Bulletin de la Société préhistorique française*, 1921, p. 201.

behind the wall, and in this hollow traces of gold, much silver, copper and iron. . . .

'This chamber was crammed with boxes containing clocks in gilt bronze, silver, an iron wine pump and various papers. We had the whole lot taken away by the owner, a wholesale wine merchant who had remained at his home to look after "poilus", at the same time we pointed out to him in another spot a cache containing gold. He then told us he had made these caches in 1914 at the time of the invasion, and that the second cache contained about 6,000 francs in gold and 55,000 in bank notes. He made haste to unearth the whole lot.'

A curious anecdote is that of a colonel, who, having been sent during the war to a sea port, employed his spare time in trying to count by means of the rod the mines protecting the harbour. He had located fourteen. The naval officer responsible for the harbour's defence happened to pass and learnt what the colonel was doing and said : 'It's strange, for your apparatus counts double, there are only seven mines'. The colonel began all over again and got the same result, so it was decided to verify it on the spot. The fourteen mines were there, seven of them having been put down by a German submarine during the night. . . .

Something of the same sort is related on page 254 of *The Divining Rod* : 'In 1927 Sir William Barrett had the idea that submarines and mines might be discovered from the surface of the water by means of dowsing ; after consultation with Sir Oliver Lodge the idea was put before the Admiralty Board of

Invention and Research, who authorized experiments to be made, which, however, owing to the expense involved, did not take place'.

We know a dowser, who being one day in a chemist's shop, experimented on a row of bottles, the labels of which were hidden. He stated that the contents of all of them were harmless, except that of one which was a compound of mercury and a violent poison : it was cyanide of mercury. The same man undertook to reclassify a lot of bottles saved from a bombardment : he distinguished Bordeaux from Burgundy and did not mistake a bottle of water for one of gin. . . .

We must here mention the remarkable ' physical ' analyses of Probst, a well-known dowser who died recently. We have learnt about them from notes on his system sent us by one of his friends (cf. p. 91). Analysing by the rod specimens of limonite, siderite, galena, he was able to tell with accuracy what they contained. The correctness of his results were consistently proved by chemical analyses.

Finally, we will mention the *Essai sur le pendule*, by M. Bosset, Professor at the University of Lausanne. It contains a narrative of the sensational experiments by means of which he, using the pendulum, succeeded in determining the vitality, fecundity and vigour of numerous fowls in an important poultry farm.

What we have just related—and far more might be told—may seem at first to be possible only to exceptionally skilled operators. But let our readers be not discouraged, it is not so complicated as it

seems. They will find in the following pages an explanation of all these seemingly extraordinary phenomena, and will acquire confidence in their ability to reproduce at will a large number of them.

CHAPTER II

THE ROD AND THE PENDULUM

EXPLANATION OF THEIR MOVEMENTS

THE dowser's instruments consist of the rod and the pendulum. We will begin with the rod. This may be of wood, steel wire, whalebone, etc. It is by no means necessary as is often supposed that the wood should be hazel.

The rod which we habitually use is made of two bits of flat whalebone, 20 to 25 centimetres (8 to 10 inches) long and half a centimetre wide. They are tied together at one end in such a way that when the other ends are parted, the apparatus takes the shape of a V. Actually this rod is a spring.

Abbé Bouly uses a stout and long rod of whalebone from an umbrella. When it turns two strong men holding the ends cannot prevent its moving.

We dislike wooden rods because they break too easily, and personally we prefer the light rod we have just described as being less tiring to use.

There are also round rods made of whalebone, but we prefer the flat ones, because in our opinion they are easier to hold and much easier to procure as they are kept by all haberdashers. The rods we use are black and so are their fastenings : we shall see later that colours can play the part of a 'sample'. For

the same reason we prefer whalebone, which is neutral, to steel which is in itself a 'sample'.

We may say that the steel rod as now used, chiefly for finding water, gives excellent results.

To use the rod—Hold it by both hands, palms uppermost, the point of the fork forwards and slightly raised. If the rod is very light and supple

Fig. 1.—How to hold the Rod

you should clasp each bit between the thumb and the two or three first fingers. If you use a stronger rod you must clasp it with the whole hand.

Advance towards the object of study—electric current, flowing water, metallic substance, etc.; when you arrive above it the rod will rise or fall. (The nature of the movement depends on causes we will examine later.) The movement may be

strong enough to cause the rod to try to make a complete revolution ; this you should help to complete by a voluntary movement which will cause the rod to return to its original position.

The method of holding the rod recommended by M. Henri Mager is as follows : 'Support the two

Fig. 2.—The Rod lifts

ends of the forks on the fleshy bridge between the thumb and the first finger ; the hands remain open and the rod is only held up by the pressure of the little joint of the third finger ; in this position the rod is firmly wedged. When the rod strikes a plane of vibration it jumps out of the hands, sometimes with great violence.

There is another type of rod very different from that just described ; it is a simple wooden switch, about eighty centimetres (32 inches) long, which you hold in equilibrium on the two first fingers or on the two hands held edgewise. While you advance you give your hands a sideways motion, bringing them towards each other and separating them quickly. When you pass over an electric current or flowing

Fig. 3.—The Pendulum on the Notched Stick

water your rod will pivot on itself and will try to take up a position perpendicular to the current. This experiment is more striking to observers than that with the ordinary rod. Spectators sometimes think that it is you who make the double rod turn more or less voluntarily, but no one can say the same thing in the case of a simple straight rod.

The second instrument of the dowser, the pendulum, is a cylinder, or ball of wood, glass, lead, or

even quartz, as one of our correspondents recommends, which is fastened to the end of a string of flax or hemp. For ourselves we always use a wooden pendulum (sphere or cylinder) some 40 grammes (617 grains or 1·4 oz.) in weight, fastened to a hempen string a metre long, rolled on a little stick with notches at the ends, the whole apparatus being painted black. The notches on the little stick admit of the string being fixed after adjustment at the proper length.

The pendulum when correctly adjusted is held between the thumb and first finger, the other fingers being spread out, and the palm kept quite open. It is then swung above the object of study—current, metal, ore, etc.—and will start gyrating either in a clockwise direction or the reverse.

What is the cause of these movements of the rod and the pendulum? It is very important that this question should be answered correctly and accurately.

As long as it be not possible to provide a really valid answer, and one in harmony with the known sciences, scientists and well-informed people will prefer to regard everything concerning the divining rod as the outcome of superstition and credulity. Any explanation based on the unknown must be avoided; it must be in conformity with theories which are to-day universally admitted, otherwise one risks being neither followed nor understood. If scientists and the public demand an effective answer, dowsers themselves, especially beginners, require one just as much. Lacking a clear and sound theory the latter are in serious danger of starting on

the wrong lines, and of engaging in a number of experiments which can lead to nothing and may draw ridicule on to themselves and our art.

If, on the contrary, the hypothesis is adopted, as we propose, that the movements of the rod and the pendulum are conformable to the theory on which wireless telegraphy is based, we enter a region of known extent and limits. On the one hand, our explanations will be understood by the public, all the more for the fact that interest in electricity and wireless is nowadays widespread; and, on the other hand, beginners for whom this book is written will realise that the only results they can expect from the rod are of a physical order, indications of the activity of electro-magnetic waves. The hypothesis will be to them a kind of safeguard.

We will now pass on to its enunciation.

One knows that the earth is traversed by electric currents called 'telluric currents'. 'The lines of the current', as the Reverend Father Ch. Poisson, Director of the Observatory of Tananarive (Madagascar), so well explains in the *Revue des Questions scientifiques* of October 22, 'will draw together in those bodies in the soil which are good conductors, whilst bad conductors will hold them in less density. This difference in the path of lines of current, due to the differences of resistance in the soil which we have just mentioned, will be manifested also by variable falls of potential, that is to say by a definite distribution of the electric field. . . . Hence we are led to believe that the dowser registers the deformations of the electric field'. These deformations

produce imperceptible modifications in our nervous systems through the effects of induction and electro-magnetic waves. The rod or the pendulum, acting as an amplifier of the reflexes, makes these effects perceptible and allows them to be interpreted.

A very simple experiment affords a confirmation of this theory. Take a bottle with a ground-glass stopper, put a piece of lead, copper or other metal inside it and do not put back the stopper : hold the pendulum over the unstoppered bottle, and it will gyrate and will give you all the usual indications of the presence of metal (cf. p. 83). Now put a cork stopper in the bottle and the result will be the same ; but when you put in the ground-glass stopper the pendulum will stop or merely oscillate.

Metal by itself cannot have given out the waves which have affected your nervous system and caused the movement which has made the pendulum gyrate ; it is some external agent which cannot penetrate glass : the agent which presents this characteristic is, as we all know, electricity.

Now try another experiment. Put in your bottle some radio-active substance. Your pendulum will gyrate quickly whether the stopper is in the bottle or not. Thus you have also an instrument which will detect radio-active minerals, liquids, etc., and one far less expensive than an electroscope for detecting radio-activity.

We must insist on this point, that our real detective instrument is our own body, our nervous system, and not, as superficial observers thought, the rod or the

pendulum. Our body plays fairly accurately the part of a wireless receiving instrument.

We really obtain a kind of extension of the sense of touch which enables us to perceive electro-magnetic waves emanating from bodies surrounding us, given out either directly by radio-activity or indirectly by contact with ambient electric currents. This extension of the sense of touch can be proved in the following manner : place your hand over a lighted stove, it will experience a sensation of heat ; withdraw it gradually, and a time will come at a distance, say, of one metre, when you will no longer feel this sensation of heat. Begin the experiment again, and the pendulum, adjusted, say, to twelve centimetres, will begin to gyrate. We have then two methods of perceiving heat through our nervous system : (1) the feeling of the hand, (2) the gyration of the pendulum.

Continue to withdraw as before ; the pendulum will go on gyrating long after the hand has ceased to feel the heat of the stove. We are therefore right in speaking of an extension of the sense of touch.

Let us carry out the experiment once more, but this time altering the point of suspension of the ball. We find that at 20 centimetres, for example, the pendulum starts gyrating. This cannot be due to the heat—the effect of calorific rays ; there must be some other cause of the movement. A wireless expert would say that we are in communication with another station. Direct contact with the hand would have enabled us to recognise the cast iron of the stove ; even if the latter had been hidden we

would have discovered it with the pendulum, and this gives us another form of extension of the sense of touch.

However, as the Reverend Father Poisson stated in a letter to us : 'To replace the organic heterodyne by an inanimate emitter is a necessary stage in the advance'. When this emitting instrument and receiver have been realised not only will our theories be justified but we will have at our disposal a most useful apparatus for checking results. 'It is probable that such an instrument will have to be extremely delicate and sensitive': so said Father Kircher in the seventeenth century. It will not be solely a register of electrical effects, but also, as we shall see, of the effects of terrestrial magnetism, probably also of calorific, geothermic and perhaps radio-active influences. The difference in the length of waves, from wireless waves to those of radium, is enormous, and affords large margin for further discovery.

The apparatus recently invented by M. Armand Viré and M. Hugues Roche (cf. p. 111) seems well suited to these requirements. Though it will no doubt be perfected it even now affords proof of the fact that the indications of the rod and the pendulum are capable of automatic reproduction and control, are of electro-magnetic origin, and have nothing to do with divination and metaphysics.

As we study the various aspects of this subject we shall appreciate the affinity existing between it and wireless telegraphy. It is this similarity which has guided us in our choice of methods for the use of

beginners, for it is not surprising to find that those which recall wireless telegraphy most clearly are the easiest to learn and to put into practice. This will become more evident in the following chapter, where the various methods will be explained so far as they can be applied to the detection of electric currents.

CHAPTER III

A PRACTICAL METHOD OF LEARNING BY MEANS OF ELECTRIC CURRENTS

WE strongly advise the beginner to start practising on electricity, as it is the simplest, easiest, and most certain way of learning.

Firstly, in working on electric currents he will easily familiarise himself with the phenomena of the rod and pendulum, which will entirely lose their mysterious quality. Secondly, with the aid of electricity it is possible to establish a complete working system which will be generally applicable, and has the great advantage that it can be practised indoors. Finally, this method lends itself to check and verification, an operation which is far more difficult when one is working on the ground in search of water, minerals or subterranean chambers.

A simple pocket electric lamp will serve the purpose. Begin by using the pendulum. It is easier to hold than the rod, which requires a certain amount of practice. The pendulum can be adjusted as regards length and weight (Ferran's method) ; this makes it in some measure suitable to everyone, and therefore the best instrument for the beginner.

Well, then, take your wooden pendulum with the string rolled round the little stick and we will carry out a series of elementary experiments.

(1) DESCRIPTION OF THE MOVEMENTS

Place on the ground or on a table an electric lamp turned on. Hold your little stick in both hands over the lamp and slowly unroll the weight, at the same time making it swing backwards and forwards in a direction inclined slightly towards the left. At a length of between twelve and fourteen centimetres, or sometimes more, according to the individual, it will begin to gyrate in a counter clockwise direction. Stop unrolling the string and put it in one of the notches. Now your pendulum is adjusted for length for an electric current. This experiment is fundamental, all the rest depend on it.

Repeat this experiment, rolling and unrolling the string until you have found the exact point at which the weight begins to gyrate.

You may have difficulty at first, but do not be discouraged ; at the end of a few trials the pendulum will gyrate at a definite point, which can be fixed almost to the fraction of a millimetre. With practice this adjustment of the string can be done very quickly, but at first much patience is required.

Do not forget in holding the pendulum between the thumb and first finger to keep the others well separated.

You can do the adjustment with one hand, especially when the point of adjustment has been nearly reached, whilst holding out the first finger or thumb of the other hand—or better still, both of them at once—as near as possible to the electric current.

All these initial movements, though somewhat

difficult to explain clearly, are in reality very simple. In the end you can hardly fail to discover the point at which the movement of the pendulum will change from one of oscillation to one of gyration. Note that the pendulum has to be swung ; starting from

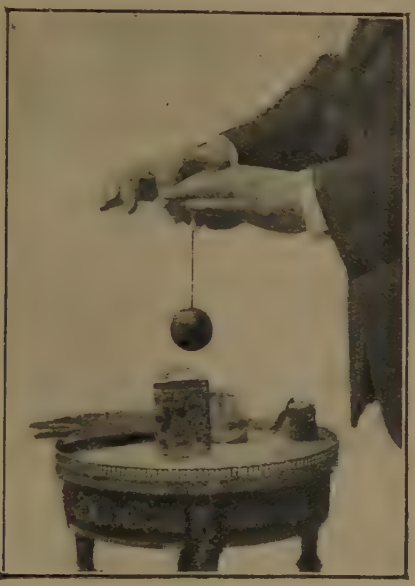

Fig. 4.—Unrolling the String over a Pocket Lamp

oscillation it assumes the gyratory movement more easily than in starting from immobility.

Finally, place yourself as far as possible in a position facing west ; this advice was passed on to us and we know it to be good.

We will call the counter-clockwise movement

positive or inverse movement, and the movement in a reverse direction negative or direct movement, this terminology corresponding to that used in connection with the poles of a battery.

You can equally well work with a basket-pendulum with an adjustable weight. First you adjust

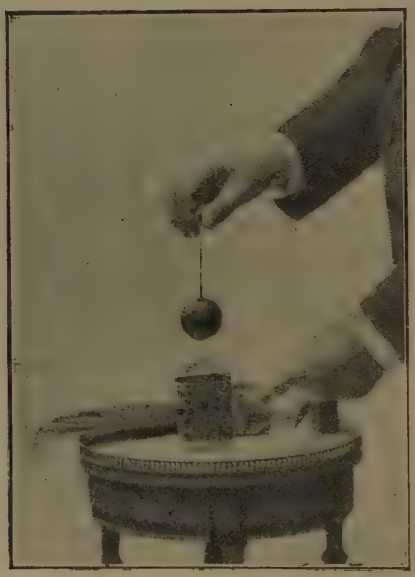

Fig. 5.—Using the First Finger as a Pointer

the length with the little stick, you then drop into the receptacle one by one light weights such as pebbles, marbles, etc. At the fall of the first weight the pendulum will begin to oscillate. After the fall of a certain number it will begin to gyrate. It will then be finally adjusted both for length and weight.

We must add, however, that for the experiments we are now describing we invariably use a pendulum of fixed weight.

You have got your pendulum to gyrate above a lamp [1] whilst holding it in the right hand. Draw back a little and point at the lamp with the first finger of the left hand or the whole left hand. The pendulum will continue to gyrate ; lower the hand and it will begin to oscillate : your hand has acted like a feeler or antenna.

M. Heyndrickx has observed that if you point at your pocket lamp with a knife-blade, needle, pin, etc., held in the left hand the pendulum will change from gyration to oscillation. But if the lamp be one of 110 volts the gyration will continue. You thus have a means of distinguishing a high voltage current from one of low voltage.

M. Alfred Mathieu informs us that you get the same result if the thread of the pendulum is held between the thumb and middle finger instead of the thumb and first finger.

If you make a deep expiration movements of gyration will change to oscillation if the current is one of low voltage (cf. p. 109).

You thus have three means of increasing your powers of perception, which will be very useful when prospecting, for eliminating insignificant flows and weak metallic impregnations.

Should your pendulum gyrate only feebly, or fail

[1] For some beginners a pocket lamp may not be of sufficient voltage, in that case they should work on a lamp of 110 volts. If you have no electric lamp, you can use an ordinary lamp, a candle, etc., in which case the influence is due to calorific or infra-red rays.

to gyrate at all owing to atmospheric disturbance or any other reason, point your first finger towards the sun and the movement will start again. The Abbé Mermet, who brought this fact to our notice, compares this weak motion of the pendulum to what is called 'fading' by wireless experts.[1]

(2) THE THREE ZONES AND THEIR SUB-DIVISIONS

Your pendulum has gyrated when held above or below an electric lamp. Now draw back and it will continue to gyrate within a zone of several metres

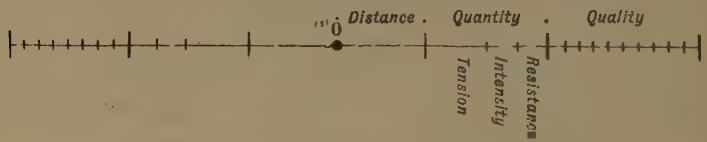

Fig. 6.—The Three Zones and their Sub-Divisions

radius. This is what we call *the zone of influence*. As soon as you leave it the pendulum will stop or will start gyrating in the opposite direction. The extent of this zone is proportional to the power of the lamp.

Return to the point of departure, say one metre, vertically, above an electric lamp, your pendulum will gyrate ; make it oscillate again and move it slowly in any direction, say the north, noting carefully what happens. At one metre's horizontal distance, *e.g.* between your hand and the vertical

[1] If the arm is stretched out skywards in a direction where there is a storm or the threat of one the pendulum if adjusted for electricity will begin to gyrate.

through the lamp, your pendulum will change its motion. As a matter of habit you must when you start such movements make the pendulum oscillate instead of letting it gyrate, then at the right distance it will begin to gyrate again. This first zone is only observable when the pendulum is at an appreciable height above the object. Note that here we are applying the method by which we determine distances and depths.[1]

Continue to advance ; the pendulum will oscillate, then, a few metres further on, will start gyrating : we have just crossed a second zone. Similarly we will discover a third zone, but after that the movements of the pendulum will become irregular : it will gyrate sometimes to the right and sometimes to the left. Now we stop, as we have reached the limit of our general zone of influence.

For the third time we will go through the performance even more carefully than before. At a distance of several centimetres from our point of departure you will notice a slight gyratory movement of the

[1] If your electric lamp is covered with some insulating material, such as a silk handkerchief, the pendulum will begin to gyrate at some distance less than one metre, say 50 centimetres. When in returning you advance towards the lamp you will get a new gyration at, say, 25 centimetres. This movement would not have occurred unless the insulating material capable of affecting the transmission of the electro-magnetic waves had been interposed.

With a stronger insulator the first gyration might have occurred at 33 centimetres and the second gyration at 11 centimetres, a third of the distance.

In the first case, to discover the correct distance of one metre, a coefficient of two, and in the second case a coefficient of three is required.

You will remember this experiment when you have to calculate the depths of water and minerals.

pendulum, due to the fact that this point is on the circumference surrounding the enlarged projection of the lamp. You will have no further movement before reaching the point marking the one metre's distance.

The second zone is divisible into three. There is a relation between the first subdivision and the tension of the current, between the second and its intensity, between the third and the resistance.

The third main zone can be divided into two or more subdivisions according to the nature of the body observed, *e.g.* ten for electricity.

You have investigated your three zones in a horizontal plane, now repeat your experiment in the vertical plane. The observations will be more difficult but will present many interesting features, especially from the point of view of one who proposes to work on the ground.

We must mention that in working at different altitudes the zones will become wider as the height becomes greater. You can easily see this for yourself by comparing the zones at one or two different heights.

This observation appears to conform with what is known of atmospheric electricity, for, as we read in the *Revue des Deux Mondes* (April 1, 1926) : 'Between the head and the feet of a man standing in the open air in fine weather, insulated from the ground by thick soles, let us suppose, there exists a difference of potential of nearly 200 volts. This is far more than suffices to light the electric lamps, which are for the most part of 110 volts, in our rooms

in Paris'. This tension naturally increases with the height : our instruments are thus enabled to measure it.

You may slur over, so to speak, one or other of the zones. In order to avoid confusion, notably between the first and second zone, it is better when you wish to study the second zone to carry out in a vertical line the movement pertaining to the first zone, then to study the second zone in the horizontal plane.

You will notice that the zones in the vertical direction are much smaller than those in the horizontal direction. Amongst themselves they are proportional one to another. Remember that this characteristic is very important so far as concerns calculations for depth and distance.

When you have reached the limit of the general zone of influence retrace your steps and return to the point of departure ; you will experience the same movements of the pendulum in getting there.

How can these movements be explained ? If you consider those in the vertical line you will find that the hand holding the pendulum in ascending and descending gives the idea of a variable condenser, the fixed part of which is formed by the ground and the dielectric by the air between the ground and the hand. It is the same thing in the horizontal plane, but in that case the whole nervous system is perhaps called into play, as is shown by the large increase of the zones measured on the ground.

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(3) PROSPECTING AT A DISTANCE

Place yourself near the electric lamp and stretch your left hand towards it, the pendulum held in the right hand will begin to gyrate. Take the left hand away and it will begin to oscillate. Stand in various places : every time the left arm, stretched out like an antenna, passes in front of the lamp and in line with it the pendulum will gyrate. Here you have an operation which in a striking manner recalls that of direction finding, one in which a frame is moved to pick up waves from a transmitting station which is out of sight and of which the direction is unknown. Repeat this experiment with the eyes shut, having had the position of the lamp changed by an assistant.

Prospecting at a distance can be carried out from points far beyond the zone of influence already studied. After the first movement you can establish your three zones in a vertical plane or horizontally as before. But it is of course preferable to operate directly over the object of study.

We see that this use of the hand as a pointer or antenna has the effect of suppressing all other influences coming from above or from below. Stand under an electric lamp (turned on) and the pendulum gyrates ; stretch out your hand and the gyration is replaced momentarily by oscillation.

(4) THE FOUR CARDINAL POINTS

Take an electric apparatus round which you can move the pendulum, a pocket lamp for example. Switch it on, and having placed it on the ground

and got several gyrations of the pendulum over it, move the pendulum round it. You will get gyrations of the pendulum at the four cardinal points of the lamp, positive movements on the north-south line, negative on the east-west line. Moving towards the north the pendulum will gyrate, going towards the south it will oscillate, it will therefore be easy for you to determine the direction of the north.

Here we have a very clear example of the influence of terrestrial magnetism.

Fig. 7.—The Four Cardinal Points

(5) THE COMPASS

When you move the pendulum round a compass you will get gyrations at the four cardinal points, but put the compass above or under a lamp and you will no longer have gyrations at the four cardinal points, but at a different point after an initial gyration at north, and then at 90° intervals. In the case of a 110 volt lamp several revolutions round the

lamp will have to be made before the pendulum passes from oscillation to gyration ; with a pocket lamp on the contrary you will get gyrations at an angle of only 40° to 50° with the meridian.

There is then a connection between these angles and the power of the source of electricity. Actually you have at your disposal an apparatus for measuring electricity.

This method can be compared with the working of a galvanometer, the essential feature of which is a magnetised bar surrounded by a coil through which a current flows.

(6) 'SAMPLES'

The word 'sample' (*témoin*, *révélateur* or *syntonisateur*—a term proposed by Dr. J. Regnault) is applied to a body which, being similar to the object of search or study, is used to assist the operator in his investigations.

In the present case, while working on electricity, the 'sample' might be an electric pocket lamp, although a 'sample' already exists in the shape of the electricity of the human body.

Prospecting at a distance is greatly facilitated if you hold a pocket lamp (turned on) either in the left hand, used as a pointer, or in the right hand ; it acts as an amplifier.

The Method of the Solar Plane—Bouly's Method

Put on the ground two lamps in line with the direction of the sun or some other source of light. When you pass between the two lamps the pendulum will gyrate. Take in the hand holding the pen-

dulum the lamp nearer the sun and begin the experiment again. When the sun and the two lamps come into the same vertical plane the pendulum will gyrate.

Now face the sun, then make an 'about-turn' and advance. The pendulum will gyrate when you are just over the second lamp. If the latter is hidden you will have discovered its position.

You can check the position of this point in the following way (see Fig. 8) :

When standing on the line *SO* between the sun and the second lamp or object, instead of making an 'about-turn' make a right turn and advance. After a few paces the pendulum will gyrate. Mark this point on the ground. Let us call it *A*. Now stand at another point on *SO*, make a right turn and advance. After a few paces the pendulum will again gyrate ; call this point *B*. The line *AB* will intersect *SO* at *O*. By making a left turn points *A'* and *B'* will be found such that *A'B'* intersect *SO* at *O*, the angles *SOA* and *SOA'* being equal.

The angle thus found is an important feature of the method of the solar plane. It varies according to the object studied and in consequence serves to identify it.

You can also, carrying a lamp as 'sample', make the experiment of the four cardinal points without the initial gyrations over the first lamp. If the latter is hidden, its meridian can be found by noting the gyrations when moving from east to west and west to east.

If you move the pendulum round a lamp, without a 'sample', and without the initial gyrations, at the end of a certain number of paces the pendulum will begin to gyrate, giving the angle of azimuth with the meridian of the lamp, the characteristic angle of the lamp in question (Mager's method).

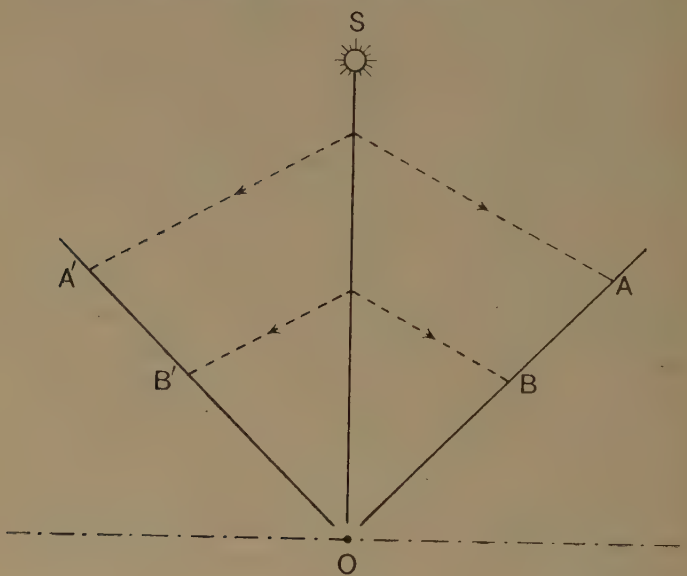

Fig. 8.

(7) THE BALANCE

Place on a level surface such as the ground or a table two lamps at least one metre apart. If they are of the same power the pendulum which has started gyrating over one of these lamps will, if it is moved, oscillate at the point half way between the

two lamps. If the two lamps are of different power, say one of 12 volts and the other of 4 volts, the pendulum will oscillate at a point three-quarters of the distance from the first lamp.

If the two lamps are set in line with the sun you get more accurate results when the lamps are of unequal power. This is the principle of Abbé Bouly's method for estimating the hardness of water.

Reverting to the experiment in which the pendulum oscillates at the middle point between two lamps of equal power, if we introduce just below this point a third lamp the pendulum will start gyrating : it is on this experiment that the principle of the detector of Abbé Ferran is based.

(8) GEOMETRICAL FIGURES

Let us go back to the experiment of the cardinal points ; you will notice that in following the north-south line you will find two points of gyration at an equal distance from the lamp, and the same on the east-west line. These points joined up form a square the outside of which you can follow with the pendulum. This geometrical figure is related to the crystalline system of the copper of your electric lamp. We will see later how this experiment can be applied for mineralogical and crystallographical purposes.

We obtain also another kind of figure, which is no other than the projection on a large scale on the ground of the outline of our lamp or of whatever electric apparatus we are using.

If the pendulum is well adjusted the lamp will be

the centre of the projection on the ground, and this projection will be the only one revealed by the pendulum. With a badly regulated pendulum, on the contrary, other fainter projections will be picked up all round the lamp. (This explains many of the mistakes made when one uses an unfamiliar pendulum.) The higher we are above the lamp the greater is the enlargement of this projection.

(9) THE CONDUCTING WIRE

It is an ancient practice of dowsers to calculate their depths on a length of copper wire stretched over the object of study. The length of the wire is in accordance with the probable depth, it may have to be more than a hundred metres long. The wire is fixed as near the ground or object of study as possible, one of its ends being vertically over this point. The pendulum being held just above this end will gyrate, and at a certain distance along the wire it will again gyrate. This distance will be either equal or proportional to the depth. In this way more accurate results are obtained than by working on the ground without a wire.

This wire has been the subject of many additions and improvements. Abbé Ferran has added to it a little electric generator. Colonel Moreau has adopted the simple device of breaking the wire with a thin zinc plate several centimetres from the end above the object studied : the contact of zinc and copper releases an infinitesimal electric current, which makes the pendulum more sensitive and consequently increases the accuracy of the result.

(10) MEASUREMENT BY COUNTING

The methods we have already referred to for measuring distances, depths, power, etc., are all linear and are calculated on the ground or on the conducting wire. But from earliest times dowsers have calculated distances when stationary by counting aloud, or by beating with the foot. Is this method essentially different from the others? Some people have thought that it has a psychical origin.

We think this view is wrong, for the method does not depend on purely mental calculation ; it always requires the accompaniment of movements, articulate speech, rhythmic motion of the foot or hand. Moreover, by counting aloud, pendulum in hand, you can distinguish zones corresponding to all those previously described.

How is this agreement to be explained? We have said that our nervous system is comparable to a wireless receiving station embodying the heterodyne principle. Calculation by counting aloud or by foot-beat corresponds to the intervention of the heterodyne, which, as in wireless telegraphy, acts by interference.

However that may be, we may say that counting can be done in three different ways. You can first of all hold your pendulum motionless and begin counting aloud. At a certain moment it will begin to move ; try to recognise at what number the movement begins : one may be mistaken by several numbers, and that is the weak point of this method.

More accurate is the following : the pendulum is

made to oscillate ; at a certain number it begins to deviate, either to the right or to the left.

The method we prefer, however, consists in counting distinct and separate sets of gyration of the pendulum, beginning a new movement of propulsion of the pendulum at each number. After a certain number has been reached there will be no gyration, or gyration in the opposite direction.

It is necessary to state that if you let your pendulum move continuously and regularly, as do some dowsers, you will find a far greater number of movements required to obtain the same result than with the method of separate movements. The last method, therefore, is easier and quicker than the other two.

Abbé Mermet uses to the fullest extent this method of calculation with the pendulum. He chooses his unit in multiples and sub-multiples and applies his system to the most varied ends, distances, powers, discharges, voltages, etc.

In our opinion this method of counting is more difficult than the linear method. It requires far more practice ; the results are always proportional, and it is necessary to find exactly what the proportion is. The linear method is of course also proportional, but in a less degree. We shall see, however, that this method of counting is in many cases very convenient, and always, as is said of certain mathematical methods, very neat in its application.

When you have performed the ten experiments with the pendulum and repeated them many times

you will have learnt the essential business of the dowser's trade. The rest of it so far as concerns the technique of investigating water, ores, animals, etc., will be learnt easily enough, given the necessary scientific knowledge regarding the object of search.

Having carried out all these experiments frequently and correctly, practise them with the eyes shut. You will then succeed in convincing both yourself and observers that your actions are not influenced by auto-suggestion.

Do not try, in an endeavour to avoid auto-suggestion, to do anything else than what has been recommended. Adopt good habits from the outset. Finally, remember that in studying the pendulum and the rod you are doing nothing remarkable ; apply the same general rule of perseverance, docility and regularity which you would follow in the study of other arts such as music, drawing, sport. To be precise, dowsing is a sort of manual work, a work which carries with it an extension of the sense of touch ; it belongs to the category of simple and straightforward crafts.

We must repeat that the real difficulty lies in the acquisition of a profound knowledge of the sciences such as geology, chemistry, etc., in connection with which the art of dowsing is employed.

THE ROD

Knowledge of the working of the pendulum is not enough, it is equally necessary to know how to use the rod.

We have already explained its general working. It is not so easy for the beginner as that of the pendulum. You cannot adjust your rod like you can the pendulum ; with the latter it is a question of patience, you know that you will 'catch' your wave between ten and fourteen centimetres of string more or less, you wind or unwind until the moment when the pendulum changes from a state of oscillation to one of gyration : with time and perseverance you are bound to succeed.

With the rod it is another thing. Take care to hold it correctly ; many people are discouraged because they have not treated their rod like a spring. It must be held in a state of unstable equilibrium and should be free to move in one direction or another quite easily.

Later, when you have ceased to be a beginner, you can allow yourself to hold it more firmly.

Move freely towards an electric current until the rod lifts. You should do the ten experiments with the rod as you have done with the pendulum, their movements exactly correspond. Frequent practice of these experiments will be more instructive than many pages of a book.

CHAPTER IV

WATER

WATER circulates in the subsoil at divers depths and in various quantities, depending on the impermeability of the underlying beds, and before making a boring it is important to know with accuracy the depth and extent of this subsoil water. The rod and the pendulum will often provide us with the means of finding water near at hand when borings made haphazard would be very laborious and would give no result.

One can easily imagine the importance of this method of research for agriculture and for the provision of water for towns and factories. It is a matter of ordinary prudence always to consult a dowser when one proposes to make a boring, and when a deep boring is in question it is as well to summon a second dowser in consultation, just as one would summon a second doctor in the case of a bad operation. To continue our comparison, just as the surgeon must not content himself with handling his bistoury with dexterity, but must have a thorough knowledge of anatomy and physiology and a fair knowledge of other sciences, so must the dowser have an intimate knowledge of geology.

REMARKS ON HYDROLOGY

Water circulates in the subsoil under different conditions : in a free state, in a capillary state (sand saturated with water), in a pellicular state (damp earth like blotting paper).

Water moves in a free state in soils known as 'wholly permeable', and in fissures of granite or limestone. It flows in them as in pipes, sometimes forming streams or veritable rivers. It is clear that when a boring is made in such rocks there is a risk of missing the water all together ; that is one reason why from time immemorial dowsers have always been found in regions where these geological characteristics obtain.

Soils of a sandy type are known as 'slightly permeable'. Water saturates the whole of such soils, either by capillary or pellicular action, and descends until it is stopped by an impermeable bed, clay or such like. We have then what is called the phreatic level. It would be a mistake to suppose that the water there is stagnant, for slopes and unequal thicknesses of the sand produce currents, and the water is circulating though sometimes very slowly.

Folds in the strata, whether anticlinal or synclinal, have also to be reckoned with, and it is useless to look for water where geology tells us there cannot be any.

The dowser then must have a thorough knowledge of geology, and especially that of the country where he is working. The behaviour of subterranean water varies not only in the main geological systems but also in their divisions and sub-divisions.

In truth, all of that branch of geology called hydrology is worthy of a more thorough investigation than it has yet received.

Information is still incomplete on the behaviour of water in relation to faults and fissures, a matter which is of great importance in connection with thermal and mineral waters, and one about which there is much to record and much even to discover.

The dowser must not only be informed on scientific questions but he must at the same time be a man of practical knowledge. If he is summoned to a farm or a factory, let him leave at the door the somewhat specialised language of geology and show his acquaintance with the various systems of pumps for deep wells, sand choked or otherwise. He might well consult the well-diggers and local contractors.

The technique of the art of the rod and pendulum is a small matter and is quickly learnt, but the indispensable accumulation of the necessary theoretical and practical knowledge takes a very long time to acquire.

WORKING WITH THE PENDULUM

We will now explain how to set about finding water. We naturally assume that you have experimented successfully with electric currents, and so, for your apprenticeship as a dowser, we recommend the pendulum for finding water as we did for the experiments with electricity.

Take a wooden pendulum about 50 grammes ($1\frac{1}{2}$ oz.) [1] in weight and adjust it for water. This

[1] When there is a wind a heavier pendulum might be used, such as a pebble in a little bag.

adjustment is found at a length of about 75 to 80 centimetres from the centre of the pendulum. You could adjust your pendulum at about 12 centimetres as for electricity, which is more convenient, but the long adjustment makes for far greater certainty in distinguishing one subterranean current from another when there are several near together. Work your little stick which carries the pendulum over flowing water until you have found the exact point of suspension at which the pendulum passes from oscillation to gyration. Let us assume that, in your case, this point is 75 centimetres. Fix the string in the notch at this point.

You have now arrived on the ground. Hold the pendulum at the 75 mark and search the area with your left arm held out as a movable pointer or antenna, the hand on edge and well opened. At a certain moment the pendulum, which has been oscillating slightly, begins to gyrate in a counter-clockwise direction ; water is in the direction indicated by your left hand. Its distance can be roughly gauged by the extent to which the left hand has to be held out. Raise and lower the right hand and you will know whether the water is more or less deep.

Now go forward, swinging the pendulum freely. At a certain moment the pendulum begins to deviate distinctly either to the right or to the left : you have found a subterranean current. Now follow your pendulum, if one may so put it ; it will accurately reveal the line of flow : in going with the current the pendulum oscillates ; in going against the

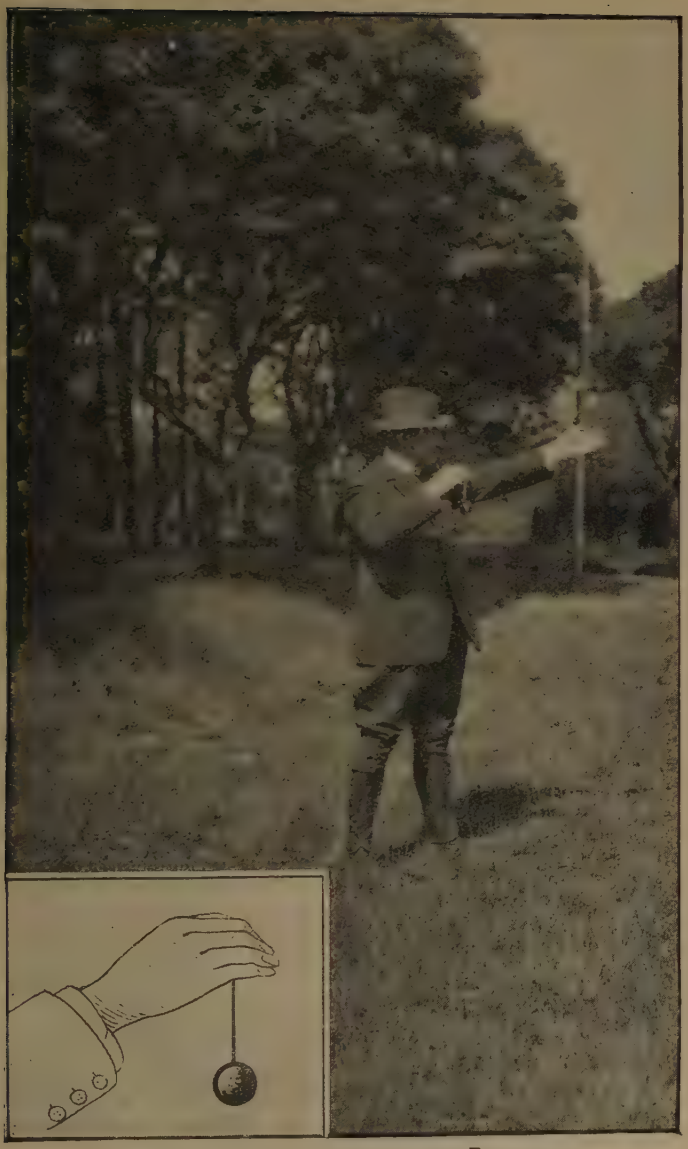

PLATE II.—PROSPECTING WITH THE PENDULUM

current, on the contrary, it gyrates. If a rod is being used it remains motionless or dips when going with the current and lifts when going against the current. Mark the line of your stream on the ground with your heel or with pegs. You have now identified one bank of the stream. You will find the other bank either by crossing the first and going on or

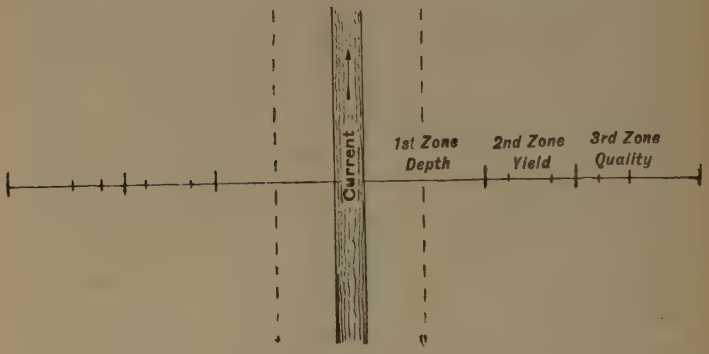

FIG. 9.—Studying an Underground Stream

by going several paces across and coming back towards the current in the opposite direction.

You will thus have delineated on the ground your subterranean stream, which often enough will be only a few centimetres wide. If you had not adjusted your pendulum accurately, or had adjusted it to twelve centimetres as for electricity (or if you had been using a rod), your stream would have had an enlarged zone on both sides. These zones sometimes mislead the beginner, who thinks he has discovered a genuine river when it is a mere trickle of

water. One must beware too of lateral projections which may be met with at a distance from the current and are a possible source of error. When in doubt remember that the pendulum gyrates in a counter-clockwise direction over a flow of water and in the opposite direction over projections and zones.

Now apply our second experiment to the stream marked out on the ground.

We are standing at a point in the middle of the current. Walk whilst swinging the pendulum in a direction at right angles to the current. After a slight deviation at the moment when we cross the bank we go on without anything else occurring for several metres, then at a certain point the pendulum deviates strongly. Stop, and it begins to gyrate, we have reached the line of minimum depth (we say minimum because several causes which we will mention later may indicate a greater depth).

Then we enter a second zone, which refers to the power of the current. Finally, we find a third zone, and with it the limit of influence.

The second zone, like the corresponding zone of the electric current, can be divided into three.

In the third zone instead of the ten consecutive gyrations of the pendulum caused by electricity we observe only two: that is the 'serial' figure for water; it should be remembered.

When using the rod there would be one upward movement at each of the first two steps.

You are walking about in search of water; suddenly your pendulum gyrates or your rod lifts.

You have come up against something, but what? You must provoke the serial movements and you will find out at once. You move forward, halting at every step, you get only two positive movements of the pendulum or rod; you are over water. Other 'series', as we shall see later, would have indicated ores or rocks. The investigation of the series, combined with the adjustment of the pendulum, constitutes a method as useful as it is practical. Remember that you can find the series on the spot by taking the zones vertically.

We must mention once more that when you have found a stream it is important to discover whether there are not others near it. To this end, with your pendulum regulated to a long string, leave the banks of the first stream, joining the hands for a moment in order to break, as it were, the influence of this current. If you are working with the rod release one of the forks.

To find water is not enough. Two great difficulties have still to be surmounted, depth and quantity.

DEPTH

We have just seen that one can obtain on the ground indications relative to what we have called the minimum depth. A very old rule, known to the most ancient dowsers as the rule of the isosceles triangle, states that the depth is equal to the distance between the middle of the current and the point where a second movement of rod or pendulum occurs.

This rule is almost exact in certain soils, but is far from being so in other cases.

There are several reasons for these variations, such as the different strata which separate the operator from the current.

M. Darder Pericas, Professor of Geology at the Institute of Tarragona, has carried out investigations with a large number of wells by inserting lumps of lead in the walls and connecting them by a wire conductor. In marking on abscissae and ordinates the depths as revealed by the rod and the exact depths he has been able to establish curves and to study their equations. These curves vary according to the soil, and this shows the important part the latter plays.[1] The pressure of water has also to be considered when sheets of water are present under artesian conditions.

The magnetic variation must be noted. M. Demarty, the erudite Director of *Le Comptoir Géologique et Minéralogique du Plateau Central*, has already mentioned this cause of error as well as that due to geothermic differences. In much the same way the Reverend Father Poisson tells us of the 'little understood reactions of the rod in places where the magnetic variation changes abruptly owing to the presence of intrusions of more or less metamorphosed granite'. Mark how this quotation

[1] *Revista Iberica*, Barcelona, vol. xxvi. No. 654. This method, which requires a knowledge of higher mathematics, seems destined to be of the greatest service in the scientific study of the rod and the pendulum. The latter, adjustable in respect of weight and length, seems particularly suitable for discovering curves and their equations.

WORKING MEN'S COLLEGE LIBRARY

affords a typical example of the value to a dowser of a knowledge of geology.

From these examples we may conclude that on first arriving in a district it is a good thing to take comparative observations of known depths. For example, sound a well and verify the depth by taking observations on the surrounding springs which feed it.

As we have explained in the tenth experiment you can measure the depth by counting, which must of course be done at a rate arrived at from consideration of known depths. You can also measure the depth on the spot by raising and lowering the hand which holds the pendulum. Suppose that water is near the surface, the oscillating pendulum will begin to gyrate when in lowering the hand from its greatest height it reaches the level of the forehead. Suppose that the water stands at 50 metres you will have to lower the hand to the level of the waist. The pendulum will gyrate for water standing at 25 metres when the hand is half way between the forehead and the waist, etc.

Having estimated whilst lowering the hand you must do the same thing whilst raising it. In order to work with greater accuracy you can hold vertically in the left hand a two metre rod or tape. You will thus ascertain the connection which exists between measurements taken by the pendulum on the two metre rod and the known depths on which you are working.

We often use this method to measure depths on the spot, it is quick and practical.

As a means of checking a depth already found, Abbé Mermet's method is useful ; it consists in taking the depth of the rock, clay, schist or other soil underlying the water by means of a 'sample'. This operation is rendered the more easy in that the movements of the pendulum with a rock as 'sample' are in a clockwise direction, hence they cannot be mistaken for movements due to water.

Finally, there is the conducting wire (see p. 46). You can stretch it either at right angles to the direction of the flow or in a N. and S. direction. It must be insulated entirely at its two ends or earthed at the end nearest the flow, but we prefer the complete insulation. At the end nearest the flow a zinc plate can be inserted in the wire (Colonel Moreau's method). You can stretch your copper wire between two pickets or get an assistant to hold one end whilst you unroll it from a wooden reel above which you oscillate your pendulum.

Whether on the ground or on the wire the distances are proportional to the actual depths ; it is most important to get as accurate a relation as possible.

QUANTITY AND YIELD

We have seen dowsers, like Abbé Mermet, determine the yield almost within a decilitre (·176 pint), but we fully realise that such feats of accuracy can only be performed by past-masters of our art. An apprentice must be content with more modest results.

He must begin by studying the connection be-

tween the yield and the width of the zone of influence, by which he will arrive at a first comparative scale. A second scale can be established by working over pipes of known yield. He must note the amplitude of the oscillations on the ground of a pendulum of known weight and length. If he be a mathematician he will be able to plot these lengths by ordinate and abscissa and construct the curve.

A third scale will necessitate the use of a compass.

You know that in going round a compass placed on neutral ground, *i.e.* where there is no water or metal, you get movements of the rod and pendulum at the four cardinal points. If the compass is placed above a flow of water you can obtain a movement of the pendulum after the north and quite near it, say at 45°, when there is a trickle of water, but only after several revolutions round the compass when the flow is strong (cf. p. 41).

We prefer not to give scales but to leave it to our readers to establish their own scales with the corrections necessitated by their geological study of the ground.

It is interesting to note that the compass can help in investigating the properties of the ground as regards water and minerals. Advance whilst holding the compass in front of you on a board. As long as there is nothing to indicate the pendulum (held at the east side of the compass) gyrates ; but immediately you are over water or metal the movement of gyration becomes oscillation.

Abbé Bouly measures the minimum yield by taking the width of the current in centimetres and

multiplying it by a coefficient given by the amplitude of the oscillations of the pendulum ; a centimetre corresponding to a litre-minute. Slow motion of the pendulum gives the coefficient 1, medium motion 2, rapid motion 3.

If you are prospecting for a large flow of water remember what we have said on p. 35.

When you are using the pendulum, insignificant flows of water can at once be detected either by extending the left hand armed with something pointed in the direction of water ; or by holding the pendulum between the thumb and middle finger ; or by making a deep expiration. In each case the pendulum will pass from gyration to oscillation.

ANALYSIS OF WATER

Arrange a solar plane (Bouly's method), represented by the sun, a glass of chalky water, for example, and a glass of distilled water. Go backwards and forwards between these two glasses whilst an assistant pours powdered chalk little by little into the distilled water. When the two quantities of chalk are exactly the same the rod will lift or the pendulum will deviate.

Instead of the glass of chalky water, work in the same way with an underground stream and you will be able to determine its hydrometric properties, since you can find out the amount of chalk per litre which has been put into the distilled water.

Better still, construct a pendulum, the weight part of which consists of a small bottle containing some

water of known quality, the bottle being suspended by a thread passing through the cork and thus becoming steeped in the water. Hold the thread at the point of suspension for water, say 75 centimetres, and walk about, oscillating the apparatus. At a certain moment the pendulum deviates distinctly and takes the direction of the sun. At the end of several paces it begins to gyrate : you are above a stream of water of the same quality as that in the bottle.

Prospecting for mineral waters and for petroleum is best done in accordance with this method of the solar plane. Remember that it should be used on every possible occasion whatever the object of search may be.

In certain notes on the methods of Probst, which have been given us, we read the following : 'You take two glasses exactly alike, which you place on the table and in the same horizontal plane. In one you put wine with a little water : into the other you gradually pour water. When there is equilibrium the rod will not move over either glass, showing that there is as much water in the second glass as in that containing the wine. For milk, work in the same manner'. One can see the possibilities of a method of this sort.

POTABILITY

Can one discover by means of the rod and the pendulum whether water is fit to drink? The question is complex and does not admit of a positive answer. We can, however, thanks to the method

of the solar plane, tell whether one water is the same as another. You can check this experiment by making the pendulum gyrate over a specimen of good water and over the water being tested ; if the pendulum gyrates in the same direction over both there is a strong probability of their being identical ; if it gyrated in different directions there would be a marked difference in quality.

An interesting application of this experiment can be made alongside a cowshed to see whether the water is contaminated. We have seen that water gives two lifts of the rod or two positive movements of the pendulum, but these movements are followed by several others in an opposite direction. If these latter are five in number beware of organic matter.

Following the method invented by M. Henri Mager you can tie to your black pendulum by a black thread a bit of blue ribbon. The pendulum will then turn in a clockwise direction over contaminated water.

Beware also of a water over which the pendulum turns in a positive direction, then in a negative direction over your left hand (cf. p. 122).

Corresponding to the five negative movements for organic matter there are analogous series for mineral matters in suspense in water ; thus, for example, chalk gives three movements, salt six : you will observe this at once if you come across hard water or saline water, etc.

SHEETS OF WATER AND SUPERIMPOSED STREAMS

You can apply in an interesting manner the method of estimation by counting aloud, by trying to determine the different planes of water that lie beneath you. Start counting. Let us suppose that at 6 your rod lifts, you can assume that there is water at a depth of 6 metres (if your beat corresponds to one metre). Go on counting, at 8 the rod lifts again : this second lift corresponds to the bed of the stream or of the watery area. You continue to count and find another stream or another sheet of water, say between 20 and 21 metres. Of course every time the rod lifts you immediately put it back to its original position.

In an experiment of this kind you must take care to release the forks of the rod, as you would do in other experiments, in order to break the influence which has caused the previous movements.

The experiment just described is very useful when you are looking for water in soils where boring is easy. In such places it is preferable to aim for the second and sometimes even the third level of water. Surface water is generally polluted and, besides, there is a danger of its disappearing during a prolonged drought.

You can also work the pendulum by counting whilst lowering the hand. When you have reached the level of the stream which is your objective you should examine it in the horizontal plane, in the way we have described in the case of the stream referred to earlier in this chapter.

You should trace on the ground the position of the stream of the first level, then that of the second ; the intersection of the two streams gives the most favourable point for making a boring.

THERMAL, MINERAL AND RADIO-ACTIVE WATERS

Thermal and mineral springs can be studied with advantage in accordance with the methods just described. By means of the method of 'samples' one can recognise in a town of mineral springs the various places where it would be worth while boring to find water of a certain quality. Frequently waters of this kind come from great depths and reach the surface, or nearly so, through faults or fissures. They sometimes flow on an impermeable bed several metres deep in the sub-soil and naturally get very cold. Our apparatus will guide us to the source of the stream and the position of the fissure. This may be of importance when it is desired to tap a thermal spring where it is hottest.

If the water under observation is such as to give fifteen gyrations, you are dealing with radio-active water. This fact can also be ascertained from the size of the zone of influence. The bottle with the ground-glass stopper (cf. p. 27) can be used for several interesting experiments.

CAUSES OF ERROR

At this point we think it will be useful to mention the causes of error which have to be reckoned with in the search for water.

The first and principal one is due to prospecting too quickly. It is as well to study the area of land several times in succession on several days, or, at any rate, at intervals of several hours.

One can easily be deceived in the exact position of a subterranean current. Do not forget to verify it with the compass (see p. 62).

The most usual mistake is in the estimation of depth. This may result either from a dense layer of soil, clay or such like, or from the mineralogical properties of the water. When you suspect an error of this kind do not forget the method described in Chapter III, p. 37. Having measured the depth, either vertically or horizontally, return to the starting point. If you find a place where the pendulum begins to gyrate contrary to expectation you must multiply the distance by two if this point is half way, by three if a third of the way, etc.

PETROLEUM, WINES AND VARIOUS LIQUIDS

Prospecting for petroleum is carried out in the same way as for water of a specified quality. There are two main causes of error. Firstly, there is a risk of confusing petroleum gas and other hydrocarbons with petroleum ; in certain cases this point would be of great interest, as it might lead to the detection of fire-damp in a coal mine. The other cause of error is that petroleum has a special coefficient of depth ; the result of your observations must be multiplied by four and sometimes more.

Petroleum gives 24 serial movements, and makes the pendulum gyrate in a clockwise or negative direction.

We have not space to enlarge on this question of prospecting for petroleum ; it requires very special and thorough geological study.

Wines, too, can be assayed with the help of our apparatus, and much interesting research remains to be undertaken in this direction. For instance, it is possible to ascertain if one wine resembles another. You should use the method of the solar plane, but at night you can work with an artificial source of light.

Wine will give a first series of four movements, which are those of alcohol ; these movements are followed by another series of an opposite kind which are constant for the same brand. Wine-growers might well be interested in the development of this use of the rod and pendulum, but at present it is in its infancy.

What we have said about wine is applicable to liquid of other kinds and may be of real help in the detection of fraud. We have already quoted examples from Probst with reference to wine and milk, and one might easily find others.

We have endeavoured to point out a working system as clearly as possible. If our readers have grasped our meaning, and have realised that there are innumerable applications of the dowser's art, our object will have been attained.

WATER AND CIVILISATION

M. Louis Forest has well said that if man has not at his disposal an easy and abundant supply of water he cannot carry on the struggle for civilisation, production and health. That is why the profession of the modern dowser, that is to say of the man who is pre-eminently the specialist in water, tends to get wider and wider. His duty does not only consist in indicating by means of his rod or his pendulum likely places for boring or digging wells ; it has a far wider scope. He should always show by his attitude in ordinary conversation and in consultations the very close connection which exists and has always existed between water and civilisation.

The whole of ancient civilisation, whether it be that of the Assyrians, Egyptians, Hebrews, Greeks or Romans, has depended in essence on the presence of an abundant supply of water. In many districts of Asia and of Africa, now transformed into deserts, are visible the ruins of vast works of water supply carried out by ancient races. It is universally recognised that it was to the existence of such works that those races owed their prosperity, and to their destruction by war and savagery that civilisation in those lands was blotted out.

Just consider that at Rome, in the time of Augustus, the daily allowance of water amounted to nearly three cubic metres (220 gallons) per head. Compare this with the following figures from statistics provided by M. Forest : Paris 424 litres (93 gallons), Lyons 320 (70 gallons), Nice 200 (44 gallons),

Bordeaux 195 (43 gallons), Lille 191 (42 gallons), Nantes 80 (17½ gallons), Versailles 73 (16 gallons). The ancient peoples exercised a wise policy in matters of water supply ; we, in our lack of any policy, give an impression of but tardy general progress in spite of our immense scientific advance.

We readily admit that the problem of providing a large town with the necessary number of cubic metres of water is a difficult one, but this is far from being so in the case of a farm, a factory, a village or even a small town.

At almost every place we have just mentioned it is possible to obtain water under pressure in sufficient quantity and at a reasonable price. We say water under pressure, for it is generally in that form that it is most advantageous. How many people there are who have excellent water at their disposal but are unable to reap the benefit of it because it must be pumped and conveyed in pipes ! Unfortunately there are some who do not realise the primary importance of an abundant water supply and thereby show themselves to be lacking in the true spirit of civilisation.

The best of all drinks is good water. It is indeed pitiful that in most districts of our country good water is unobtainable and people are obliged to purchase expensive mineral waters. Now good drinking water exists almost everywhere ; it is only necessary to make a boring to the required depth, and this any dowser who knows his trade can indicate with sufficient accuracy. Indifference on the subject of drinking water in our country is a

perpetual source of surprise to foreigners ; most of our neighbours, indeed, look upon this question as one of the greatest importance, and in dealing with it satisfactorily consider no sacrifice too great. Impressive statistics can be quoted to show that the rate of mortality is directly dependent on the supply of good drinking water. Alas ! it is France who stands at the head of the list with the highest death rate.

Country people sometimes say that they are indifferent on the subject because they do not drink water. . . . This is a mistaken idea ; water enters into the composition of their daily drink (cider or wine), and if it is contaminated by organic matter fermentation will destroy by no means all the dangerous microbes. And what about the bad water which we often allow cattle to drink ; it is a frequent cause of epidemics.

Water is indispensable not only for man and beast, but is used in great quantities for cooking and washing and for cleaning of all kinds in the house and farm. It is required for bathing by human beings and animals, for watering gardens and for extinguishing fires. The universality of the question is obvious.

INSTALLATION OF A WATER SERVICE

In order that water may be easily accessible an installation has to be arranged with, if possible, both hot and cold water laid on, according to modern ideas of comfort.

There are many different systems, but it is neces-

sary to know the principles to find out which will be the most advantageous. The object in view is to have available under pressure as much water as possible at the cheapest possible cost.

We will examine several typical cases. Let us assume that there is a farm, or even a village, situated at the foot of a hill with a water-bearing stratum above it at a moderate depth. There are neither houses nor stables on this hill, and the water has been passed as drinkable both by the dowser and the chemist. The dowser would not in such a case recommend a boring ; he would suggest making a trench to collect water from the hill and piping it to points of distribution where, in accordance with what we have said above, it would arrive under pressure. In this case the expense of trenches and laying on the water in pipes would probably be less than that of a boring and a mechanical pump. However, if the power already existed in the shape of a fall of water it would be worth while estimating for its use. Another gratuitous form of power worth considering is the wind ; good air motors are now obtainable.

We have often been asked to advise on the supply of water for pasture land. A good deal of ground has been turned into pasture in the last few years, but the watering of the animals on it becomes a very complicated matter when there is no obvious source of water. A boring is often a solution not to be recommended. Sometimes the boring would have to be very deep, entailing a cost out of all proportion to the result ; sometimes it would be shallow, but

tapping a sheet of water liable to disappear in times of drought, just when it is most wanted. A good way of dealing with the problem is to install a concrete cistern with a pump and trough at a low point in the field, fed by channels arranged fan-wise so as to collect rain-water. A simpler arrangement is to make a concrete drinking-trough in a favourable position for collecting rain-water direct.

Frequently the position marked out for a cistern or trough almost exactly coincides with that in which a boring could be economically carried out. Do not hesitate to have one made even if you are not certain that the supply will last in years of great drought. Its value in other years will justify your action.

Boring by tube-well deserves special notice, for it is really economical and may prove of the greatest value. It is carried out by means of an iron tube with a steel point and copper grating to filter the water. The tube is driven by a ram consisting of a frame with two pulleys, a hand monkey, a cast-iron collar fitted with two wooden pads and several metres of rope. In a recent catalogue the price of this apparatus is given as three hundred francs. To this must be added the price of a pump and so much metre run of iron pipe, together with sockets. The whole cost is not great. This system is suitable for depths of six or seven metres If you find a water-bearing stratum at less than seven metres you can drive your pipe to a second stratum. We have in this way driven pipes successfully up to depths of thirty metres.

Remember that by reaching the second stratum one is sure of obtaining water which is unpolluted and is unlikely to dry up. Note, however, that this boring cannot be carried out in every kind of soil. It must not be too hard, nor must it be so stony that the pipe is liable to be deflected.

Many well-sinkers possess this economical outfit for boring, but seeing how cheap it is, and how easy it is to work, it ought always to be found amongst the implements of large farms, agricultural syndicates and colonial contractors.

From economical boring let us pass on to industrial boring of the kind used in mines for great depths. The expense varies from two hundred to six hundred francs per running metre, according to the nature of the soil. Evidently the sum involved may be very great, but it often happens that a large agricultural establishment, a factory, or a municipality, will without hesitation enter on far greater expenditure with a prospect of a much less useful result.

When the nature of the ground and the hydrological system of the country necessitates a deep boring the most elementary prudence prompts one to consult a dowser with good geological knowledge. The contractor carries out his work on the spot indicated, but he cannot guarantee that water will be found. We have seen money thrown away on a boring of more than 100 metres, whereas if a dowser had been consulted he would have been able to say that at a point a little way off water could have been found at 50 metres, and that by following up this stream for 200 metres an inexhaustible water-

bearing stratum would have been struck, the existence of which could be assumed from neighbouring borings, by geological maps and by information from local well-sinkers.

These deep borings have to be undertaken in making artesian wells, but the discovery of the genuine artesian well is an ideal seldom realised ; sometimes unsuspected faults drain the water away, sometimes the permeable stratum on which one was reckoning changes in type or thickness and ceases to hold water. Here, again, a dowser who knows his trade can give useful information and prevent many grievous mistakes.

When water does not rise to the surface of the ground and has to be sought at great depths, various systems of raising it are used, and several give excellent results ; for example, the various systems of bucket and deep-well pumps.

In many places there exist old wells of great depth ; it is easy enough to-day to modernise them and to bring water to the desired spot by one of the apparatus of which we have spoken. If the site of the well has been forgotten the dowser can discover it in the same way as he discovers a cellar or an underground chamber. (Cf. p. 99.)

Do not forget that if you have a fall of water or if you can arrange one you are in a position to use the hydraulic ram, which is the most practical and economical instrument for attaining our end. And note that there is a type of hydraulic ram in which, given the necessary fall, muddy water can be employed to raise clean water.

Let us assume that you possess water in abundance and that you have motive power available : a ram, air-motor, petrol engine, or electric motor. We may mention here that for small installations the motive power required is very slight : often only ¾ H.P., and is consequently not a source of great expense. Your motive power will enable you to get your water to a reservoir. The latter may be a raised one either under a roof or in the open air. This is an economical arrangement, but frost must be guarded against. With the reservoir in a cellar, and apparatus for distribution under pressure, the inconvenience of frost is avoided, but this method requires more attention and is more expensive.

It is obvious that the problem of water supply is much less difficult to solve than many people think, and one can safely say that the farm, the factory, the village, and the town which at the present time are not provided with an abundant water supply are either the victims of bad advice and ignorance or are guilty of the most regrettable neglect.

USE OF THE ROD

The rod, as we have already said, is used on the same principle as the pendulum. We prefer the pendulum for finding water, but the rod is more dependable when there is wind. In spite of the wind the evidence of the rod is always clear, and one can't say as much of the pendulum.

The direction of a stream can be found by pivoting on the heels ; the rod will lift when you are facing it, thus showing the direction in which to advance.

If you hold the rod raised, for example, at the level of the forehead, it will dip when you arrive over the current or on its parallel projections. If you hold it at the level of the waist it will lift. Nearly always your estimate of depth can be made in this vertical zone from the forehead to the waist, just as you obtain the same information when using the pendulum.

We will mention here a pertinent experiment of Abbé Ferran. Having noted a spot pointed out by an operator with the rod, he takes his stand on the line with his pendulum and adjusts it by weight till it passes from oscillation to gyration. The pendulum being thus adjusted he will find exactly the same indications as those given by the rod at any other place.

It is, therefore, possible to check the evidence of the rod with that given by the pendulum, and to note the corrections to be made in order to arrive at accurate results.

We must add that certain dowsers often prefer to use a rod with long forks which they hold at the end. It would, therefore, appear that the rod is capable of a certain measure of adjustment.

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CHAPTER V

ROCKS, ORES, MINERALS AND METALS

GEOLOGICAL study and prospecting for mines are extremely interesting occupations, but unfortunately in their pursuit one can only be guided by what is visible on the surface.

How often in the course of a walk, before we knew how to use the rod and the pendulum, have we not longed for some instrument which would enable us to read below the surface, acting for us as the telescope for the astronomer and the microscope for the biologist. Excavations which used to be merely troublesome when labour was cheap can now be carried out only at ruinous expense. From the industrial and economic point of view this state of things tends to become more and more serious.

A quick and practical method of identifying rocks and ores would be of the greatest value. This operation now requires the use of test tubes and other laboratory apparatus not available in the field ; nevertheless, those who wish to prospect for minerals by dowsing would do well to learn how to check their results by means of the test tube. They will find all necessary information on this subject in the authoritative work of A. Braly, *Détermination et étude des minerais* (Paris, Vénéziani). For the be-

ginner, however, E. Barral's *Tableaux synoptiques de minéralogie* (Paris, J. B. Baillière) would suffice.[1]

In order to demonstrate clearly the possibilities of the rod and pendulum we will examine in detail the problems which have to be solved. On the one hand we will show those who already know something of geology and prospecting how advantageous a knowledge of the use of the rod and pendulum will be to them ; on the other hand we hope to provide beginners who have never studied geology with some elementary information on this subject which will, we trust, call forth a taste for this attractive science.

To this end we think we cannot do better than quote this splendid page from *A la gloire de la Terre*, that charming book by M. Pierre Termier :

'Would you know the reason of this peculiar hold which geology has over each one of its disciples ? I will tell you. It is the mystery of geology which attracts us ; it pleases us no doubt by what it tells us, but still more by what it withholds ; what draws us to it is its kinship, closer than that of any other science, to the Unknowable ; pleasing to us is the unplumbable abyss, suddenly visible at every bend of the road by which it leads us ; and specially pleasing is the murmur of its divine voice often scarcely audible, in which the same awe-inspiring words unceasingly recur, the three words man cannot fail to hear and which are as the tripod on

[1] English books on the subject are *Mineralogy*, by Rutley, revised by H. H. Read (Murby), and *Mineralogy*, by F. H. Hatch (Pitman).

which the whole of his philosophy is based : Time, Life, Death. Geology is the sister of Time ; it is Geology that knows the unfathomable secret of Life ; which will write with a quiet hand the last page of the history of mankind. We feel it when full of terrifying mystery it passes by us, and we love it with a love beyond all reckoning. It is the science which the poets favour, for it does not demand the sacrifice of any illusion but on the contrary calls on them to widen the scope of their dream and to follow its course from the beginning of days to the ending of the final catastrophe.'

The geological student who wants to apply his knowledge in a practical manner must first of all be able to recognise the principal rocks and minerals which he is likely to meet in his expeditions. This is the object of the two sciences of petrology and mineralogy. As a start let us note the following :

Rocks include :

(1) *Sedimentary rocks*, *i.e.* those derived from deposits made by the action of water, such as :

Limestones (chalk, lithographic limestone, common limestone, oolitic limestone, marble, calcite, Iceland spar, marls, dolomites).

Silicious rocks (quartz, flint, millstone grit, sand, sandstone, pudding-stone, breccia, tripoli, quartzite).

Argillaceous rocks (plastic clay, china clay, marl, slate, schist, shale, ampelite, mud).

Saline rocks (gypsum, rock salt, phosphate).

Carboniferous rocks (coal, lignite, peat, oil shale).

(2) *Volcanic rocks :*

Granitoidal rocks, granite (felspar, black or white mica, quartz), granulite, pegmatite, syenite, diabase.

Porphyritic rocks (porphyry, trachyte, basalt).

Vitreous rocks (obsidian, pumice).

(3) *Schistose rocks* (gneiss, mica-schist).

The principal ores are :

(1) Iron : oxides (magnetite, oligist, haematite, red ochre, limonite, oolitic iron, yellow ochre). Carbonate (siderite). Sulphide (yellow and white pyrites). Native iron.

(2) Copper : carbonate (malachite). Sulphide (pyrites). Native copper.

(3) Lead : sulphide (galena).

(4) Tin : oxide (cassiterite).

(5) Zinc: carbonate (calamine). Sulphide (blende).

(6) Nickel : silicate (garnierite).

(7) Mercury : sulphide (cinnabar).

(8) Silver : sulphide (argentite). Native silver.

(9) Gold : native gold.

To this list we must add cryolite (a fluoride of aluminium and soda), stibnite (a sesqui-sulphide of antimony), realgar and orpiment (sulphides of arsenic), pyrolusite (manganese dioxide), baryta (sulphate of barium), etc.

The above are the essentials of a little collection which you can make yourself or buy ready made at a reasonable price. You can complete it at leisure with a number of very interesting minerals which we have not been able to include in this short list.

The collection will need a book to support it ; we cannot recommend a better both from the scientific and practical point of view than *Géologie et Minéralogie appliquées*, by Henri Charpentier (Paris, Dunod, 1927).[1]

MINERALOGICAL EXAMINATION

Now that you have all or a part of your specimens, study them with the rod, or preferably with the pendulum, which lends itself better to laboratory experiments.

Begin by putting the stone, as M. Henri Mager recommends, 'on its base, and in the "position of greatest activity"'. This is done in the following way : face the west, holding the pendulum to the north of the stone, turn the stone round until the pendulum passes from oscillation to gyration. Then turn the stone on its axis ; the pendulum oscillates ; go on turning until the oscillating pendulum begins to gyrate. If possible put your specimen on a table containing no metal of any sort (not as shown in Fig. 10).

This method of placing and orientating our piece of rock or specimen of ore will be particularly useful for experiments in geometrical crystallography to which we will soon refer.

For the present, unwind your pendulum over the stone until you have found the exact point at which gyration begins ; this will be in a positive direction

[1] English books on geology are Lake and Rastall's *Text Book of Geology* (E. Arnold), and Geikie's *Structural and Field Geology* (Oliver & Boyd).

in the case of a metallic body and a good conductor, and in a negative direction in the case of a bad conductor.[1]

We now investigate the 'series', *i.e.* find out what number of sets of gyrations is appropriate to that

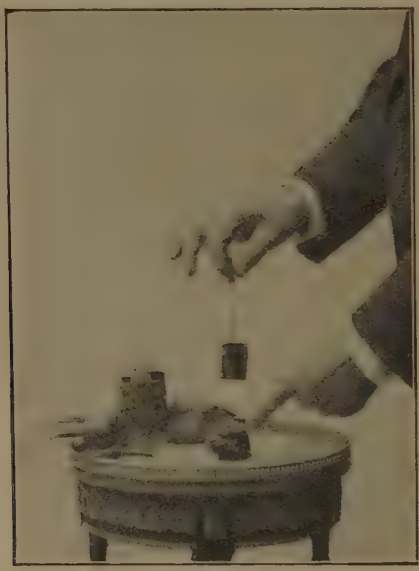

Fig. 10.—Examining a Specimen of Ore with the Pendulum

particular body. This number will be the same either in the horizontal or vertical direction.[2] The

[1] For a small piece of ore the action will be increased by advancing the thumb and first finger until the ore is between them, without being touched by them (cf. p. 32).

[2] You work in the vertical direction by raising the hand through the successive vertical zones, and in the horizontal direction by slowly withdrawing the hand and so discovering the successive horizontal zones, which may extend over several metres.

'series' consists of a number of periods of gyration, taking place one after the other, a new impulse being given to the pendulum each time. For example, having obtained gyratory movements of the pendulum over, say, an electric lamp or battery, you stop the movement; you then start the pendulum oscillating, and it will again gyrate; again you stop it, and so on for ten times in succession, after which the pendulum will gyrate in the opposite direction or merely oscillate. Thus 'ten' is the 'serial' number for electricity.

We will give some examples:

Sedimentary rocks give us the following negative (clockwise) series:

Chalk, 3; flint, 5; sandstone, 6; diamond (pure carbon), 6; coal, 18 (3×6); petroleum, 24 (4×6).

Ores will give us: iron, 4 [oxide (4+2), carbonate (4+3), sulphide (4+10)]; copper, 5; zinc, 6; silver, 7; tin, 8; gold, 11; mercury, 12; lead, 13; etc. For the oxides, carbonates, etc., of these metals, work as for those of iron; that is to say you first obtain a positive series due to the metal, followed by a second in the opposite direction, due to the component oxide, carbonate, etc.

You can yourself complete your list of series, and by the various serial numbers you will be able to identify stones and minerals not already known to you.

Let us continue the study of our system of identification.

We have recognised a mineral, we want to find out whether a certain other mineral which has given

us a similar series is really of the same composition. Use the method of the solar plane. If the rod lifts when we pass between the two specimens, placed on the ground or on a table in the solar plane, it is probable they are the same. Now observe the angles, which must always be the same for any particular ore. To finally check take the pendulum, and if it gyrates over our two specimens in the same direction, especially when we hold the thumb of the left hand as a pointer near the first specimen, we have a strong confirmation of our result. The methods described on pages 95 (Ferran) and 105 (Heyndrickx) can also be used.

THE SELF-ADJUSTING PENDULUM

You can adjust the pendulum on itself, so to speak, with a piece of ore, metal, etc., at the end of the thread as a weight, or clasped between the thumb and the thread on the little notched stick, when using the ordinary pendulum.

You obtain movements of gyration with the ore forming, as it were, part and parcel with the pendulum, just as you do when a wooden pendulum is held over a piece of ore or metal.

When your pendulum with its weight of ore is adjusted and gyrating you hold it over the ore you wish to study. If it is of the same composition as the weight the gyration of the latter is at once transformed into oscillation.

This self-adjustment of the pendulum forms a good means of check and is useful in a multitude of ways.

THE PENDULUM AND CRYSTALLOGRAPHY

An interesting experiment consists in discovering the primitive crystalline form of minerals with the help of the pendulum.

For example, put on your work-table or on the ground a piece of galena (lead sulphide). In manoeuvring your pendulum you will find four points of gyration at equal distances from the centre on the north-south and east-west lines ; these points are at the four corners of a square (cf. Fig. 7, p. 41). The same thing occurs in the case of copper, silver, gold, etc., the crystals of which belong to the cubic system. Other bodies will give a rhombus, others again a hexagon, a rectangle, etc. Obviously we cannot expect to reproduce all the properties of the crystal appropriate to any sort of ore, but it is something to be able to say at once to what crystalline system the mineral belongs.

Note also that the angles found in using the method of the solar plane seem to have some connection with those of the crystalline system.

COLOURS

From geometrical crystallography we pass quite naturally to optical crystallography.

Let us compare by means of the pendulum our metals and ores with the prismatic colours.

Our apparatus will consist of a black pendulum with black string and stick or a black rod with black binding,[1] a sheet of black paper and seven

[1] Black is only necessary when operating with colours.

bits of ribbon, coloured violet, indigo, blue, green, yellow, orange and red, respectively.

Put a piece of chalk on the sheet, and several centimetres away the violet ribbon ; the pendulum will gyrate in the same direction over these two bodies, and each will give three gyrations. Indigo and iron will each give four gyrations, copper and blue five. Green (indigo and yellow) acts like gold and gives eleven gyrations, silver and yellow seven, tin and orange eight, platinum and red ten.

If we combine colours, and join a red ribbon to a violet, we get the same reaction as for lead, namely, thirteen gyrations. Radio-active substances give fifteen, as for red and blue. Green and yellow like coal give eighteen gyrations. White counts as one, consequently violet and white, equivalent to indigo, cause three plus one, or four gyrations, as does iron.

From this experiment we can draw the practical conclusion that bits of coloured ribbon can be used as 'samples'. With a black rod or pendulum (black denoting the absence of colour) you can carry out all the experiments in which 'samples' play a part, holding between the thumb and first finger in contact with your apparatus one or more bits of ribbon.

We must admit, however, that in prospecting we prefer the genuine 'sample', consisting of a bit of rock or ore exactly similar in nature to that which we are looking for. The prismatic colours, however, offer a ready means of check, and for that reason their use should not be ignored.

We have just experimented with colours in their relation to certain substances, but if we study them

independently they give negative series as follows : violet, 6 ; indigo, 7 ; blue, 8 ; green, 9 ; yellow, 10 ; orange, 11 ; red, 12. We may add that these series are in inverse ratio to the vibrations of the rays of the solar spectrum (450 trillions for red, 750 for violet, etc.). It is hardly an exaggeration to say that this type of experiment presents very important possibilities—such as the appreciation of colours by a method independent of vision.

MAGER'S METHOD

We cannot leave this fascinating study of colours without mentioning, for the benefit of those of our readers who are interested, the important books which M. Henri Mager has devoted to the subject : *Les Sourciers et leurs procédés* and *Une Science nouvelle* (Paris, Dunod). The principle of his method is—a rosette is drawn, divided into eight sectors coloured and orientated as follows :

North, violet ; north-east, blue ; east, green ; south-east, yellow ; south, red ; south-west, grey ; west, black ; north-west, white.

Working round this rosette one obtains movements of the rod (black with white binding) at the four cardinal points. If copper is placed on the red sector, in its 'position of greatest activity', (cf. p. 83) the movements at the four cardinal points no longer occur ; but if the copper is put on the violet sector they again take place.

Continuing the experiments you will find that if paramagnetic bodies are placed on the red, iron, for

example, the four cardinal points will cause reactions of the rod ; similarly, if diamagnetic substances such as copper are placed on the violet sector the same result will be obtained.

This rosette will serve as a foundation for studying all possible varieties of substances, minerals on the north and south sectors, vegetables and organic substances on east and west sectors. Many bodies are effective in suppressing the indication of the four cardinal points only when they are placed at the intersection of two sectors. A rod painted with the colour of the sector will act as a 'sample' for the search and study of the body, which, when placed on that sector or the intersection of two sectors, causes the suppression of the movements of the black and white rod at the four cardinal points when one is working round the rosette.

Before leaving the subject of M. Henri Mager's book we must mention his method of identifying ores (cf. p. 44). You work round the metal as you have just done round the rosette. Note the point at which you obtain the first movement of the rod, which will always be the same for any particular metal : for gold at the south, for silver at the south-east, etc. Calculate the angles thus obtained with the meridian of the metal under observation. Keep a list of these angles and you will have another aid to inquiry and check.

ANALYSIS OF ORES

We will now start another branch of study, that which concerns the contents and richness of ores.

It is a subject of great importance, as a specimen can give all the indications of a precious metal whilst containing only an infinitesimal quantity.

It is very easy to estimate the richness of an ore. Refer to the experiment of the three zones (p. 36). When the pendulum is held immediately over the specimen, the first zone, that of depth or distance, is of course non-existent, and the zone first measured is that of quality or richness. The size of this zone is a measure of the richness ; you must formulate your own scale. When a complex ore is being examined a 'sample' of the particular ore you are investigating must be used.

By means of the methods we have explained with reference to water you can obtain very accurate results, principally by the method of the solar plane. The only difficulty is in getting the powdered metal for analysis, as it is less easy to obtain than is chalk for hydrometric analyses.

Probst, who often practised this 'physical' analysis of ores, obtained results of remarkable accuracy. We will give some examples of his results which were verified by chemical analysis. He told us he was so sure of himself that in case of disagreement he would ask for the chemical analysis to be repeated. . . . A piece of limonite (hydrous ferric oxide) revealed to him 262 grs. oxide of iron and 4·52 grs. of manganese. In taking some pure iron as a 'sample' instead of oxide he found for the iron 165 grs.; the specimen weighed 320 grs.

A complex ore was found to contain 18 grs. of galena, 18 grs. of siderite, 6 grs. of chalcopyrite,

22 grs. of iron pyrites. These figures give some idea of the accuracy of his method. To estimate the quantity of pure metal Probst drew up a table of multiples, as follows :

Bauxite (aluminium) - - -	0·536
Cassiterite (tin) - - - -	·786
Siderite (iron) - - - -	·77
Red haematite (iron) - - -	·725
Pyrolusite (manganese) - - -	·63
Garnierite (nickel) - - -	·785
Calamine (zinc) - - - -	·802
Blende (zinc) - - - -	·67

Probst proceeded in these analyses by placing on a table 30 to 40 centimetres apart his specimen of ore and his trial powders or packets of equivalent weight. When the pendulum gyrated over the specimen an assistant poured the powder very slowly, until, when the right quantity was reached, the pendulum ceased to gyrate.

ANALYSIS OF SOILS

The procedure with the pendulum just described can be used for agricultural purposes for discovering whether any particular soil contains the necessary quantity of phosphate, potassium or lime. The 'samples' required will not be difficult to obtain. You take samples of earth from immediately below the surface at different points of the field you wish to examine. You thus obtain some half dozen spadefuls of earth which you mix together and pass through a sieve to remove stones, roots, etc. It only remains to analyse your earth in the manner

just described. In the first place you get rough and ready indications from the study of the zone of influence with the 'sample'. If this produces no result it is useless to go on. If there is an appreciable zone, carry out the experiment of 'equivalent weights'.

This method can be applied for various industrial purposes, though we do not claim that it will ever supersede chemical analysis. But the latter is often long and expensive, and a preliminary analysis with the pendulum may prove of great value by inducing one to undertake a chemical analysis which otherwise would not have been thought of.

ESTIMATION OF DISTANCES

You should now continue at home your experiments on rocks and ores by repeating the experiments for distance and depth which you have already practised. Put a specimen of ore or a piece of metal in a room adjoining yours, taking care, of course, that it does not already contain a similar mineral, and see if you can find its direction and estimate its distance.

A 'sample' is essential, and you must use the method of 'prospecting at a distance', with the left hand stretched out as a feeler or antenna. When the hand is pointing in the direction of the ore the pendulum will gyrate. Try to calculate the distance by counting, as for estimating depths in our tenth experiment, and also by means of the two-metre rule or tape (cf. p. 60), held in this case horizontally.

You must pay particular attention to one circumstance which frequently misleads those who are seeking small hidden objects. When you have found the direction of your object, and have advanced slowly along it, the pendulum will, after you have taken several steps, pass from oscillation to gyration. You are not yet over your object, but the geometrical figure is beginning, or will begin at the next set of gyrations. Follow your pendulum, which is, so to speak, about to draw the figure—square, rhombus, rectangle or another—on the ground. You must take the middle, and the object will be under that.

Train yourself by often carrying out this experiment first on visible objects and then on hidden ones.

You will notice that you can find the geometrical figure of an ore, either by approaching it, or by retreating from its centre, at first on the north-south line and then on the east-west line. To find the shape or the enlarged perimeter of the object you can retreat from it in any direction, but must not use any but a well-adjusted pendulum.

A properly regulated pendulum is indispensable for finding this perimeter and avoiding the influence of the 'images' reproduced round the object sometimes in a manifold degree. When there is a danger of confusing the real perimeter and the 'images' the method described for impregnations should be used (cf. p. 107).

You can also practise the method of the solar plane, the sun being replaced by another source of

light in the house or at night. In this event there should only be one lamp, as two sources of light have distinct amplifying effects which may be antagonistic to each other.

You can estimate depths by working from different floors of your house, acting as we have already described in the case of water, but always with 'samples'.

An interesting little device is the detector with two 'samples,' the idea of which is due to Abbé Ferran.[1]

You fasten on a thin board two pieces of metal or mineral of the same size in such a way that they cannot move. Hold over the board your pendulum, with a third piece of mineral or ore as a 'sample',[2] so that it forms the apex of a triangle. The pendulum when held above the first piece on the board will gyrate ; you then move it towards the second piece. Half way between the two, if they are of equal size, the pendulum will oscillate. If they are not equal the point of oscillation will be nearer the smaller.

Now walk about with this apparatus. So long as there is no metal of the same nature below the oscillation will continue, but if you pass above a similar substance the pendulum will begin to gyrate. Here we have a very practical method for easily verifying the presence of a metal or mineral

[1] We must mention also the pendulum with two 'samples' placed apart from one another in the same horizontal plane in the basket pendulum. This arrangement, shown us by M. Heyndrickx, increases the sensitiveness of the pendulum.

[2] But this is not essential.

immediately below any given point. We must point out that with this apparatus, when you approach the vein or the metallic mass, the pendulum oscillating half way between two bits of mineral of equal weights will begin to oscillate in the direction of the vein.

This detector or compensator with its two 'samples', 20 centimetres apart, and a pendulum, forms a most effective prospecting apparatus which we use as often as possible. It possesses the great advantage of eliminating all other influences save those which harmonise with the 'sample', just as in wireless certain powerful or near stations dominate those which are weak or distant.

GEOLOGICAL STUDIES

A geological map is, as its name implies, the outline on a topographical map of the boundaries between the various geological masses where they reach the surface of the ground.[1]

Evidently such maps can give but meagre information, either from the point of view of the prospector or the agriculturist, as they only describe the soils near the surface. It could hardly be otherwise, for geologists cannot be expected to make borings at close intervals all over the country. We suggest, therefore, that it would be an interesting and useful exercise for our readers, who are by now familiar with the handling of our instruments, to supplement

[1] *La Géologie mise à la portée de tous*, by R. d'Andrimont (Paris, Dunod), p. 96.

the geological map of their district by taking observations below the surface.

We advise them to proceed from the known to the unknown, as in all other kinds of investigation. In this case starting points should be made at known sections of land, valleys, wells, quarries, &c., and the various strata followed up.

Let us recall certain well-known definitions and facts. These beds or strata have been deposited by the sea. They are said to be conformable when they are parallel and unconformable when they are not. Strata may be horizontal or in folds. Their folds may be simple or they may be broken and dislocated sometimes over considerable lengths.

In the event of dislocation the surface may be torn up bodily and removed to a great distance. We have to discover the depth of these various strata, or at any rate their depth to a lower point than that given on geological maps as at present made.

When tracing any particular stratum the compass-bearing of its direction (or strike) must be recorded, and also its inclination to the horizontal (or dip) ; this can be done by means of a clinometer, a little instrument consisting essentially of a plumb bob fixed at the middle of an arc divided into two sectors each of 90°. The clinometer is often combined with a compass.

When dealing with sedimentary rocks which have been deposited in thin beds, as can be seen in certain wells, those which are homogeneous and dense react to the pendulum much better than those which are not so. Select one such bed, put a piece from it in

a little bag, connect it by a thread to a little stick, and you have a pendulum specially adapted to its purpose. Starting from a known depth, go forward, always keeping in touch with your stratum, which will be the case as long as the gyrations of the pendulum are in the same direction.

From time to time estimate the depth by a vertical movement of the hand which holds the pendulum, combined with counting. By means of the results noted at different spots and recorded in your note book it will be easy with a little practice to find the inclination and direction of these invisible beds, of which a knowledge of the situation is sometimes so useful.

With different 'samples' you can, of course, locate different types of strata.

Strata are separated often by well-defined joints called bedding planes. If a joint becomes discontinuous by reason of a vertical displacement of a mass of rock forming a rent in the earth's crust this rent is called a 'fault'. When the stratum is broken without vertical displacement the rent is called a fissure.

The depth of a fault can be found by taking up a position immediately over the subsided mass, finding the depth of the stratum and comparing it with the depth on the other side of the fault.

By means of the pendulum and rod you will have no difficulty in following up rents of various kinds. When you are walking over the ground with the rod slightly inclined towards the ground it will incline still more in a very pronounced manner as you

pass over each rent. You can thus easily follow up a fault as well with the rod as with the pendulum, just as you follow up a subterranean stream. You will get the impression, whichever instrument you are using, of butting up against an invisible wall which repels you as you go along it. You work with your pendulum rather in the manner of a child who walks alongside a wall whilst repeatedly bouncing its ball against it.

The explanation of this clear indication of rents probably lies in the break of continuity which has a very distinct effect on the earth currents. It should be noted that the movements of the rod and pendulum when a fault or fissure is being traced are alternately positive and negative.

CAVITIES AND SUBTERRANEAN CHAMBERS

In certain rocks the action of water tends to enlarge the fissures in them and to turn them into veritable cavities. They can be found in the same way as faults. You adjust your pendulum and estimate their depth either by counting or measuring on the ground on the side remote from the sun, as Friar Padey very aptly recommends. The first result obtained refers to the apex of the cavity, the second to its base. You find the perimeter of the cavity as if you were following a line of fracture.

The pendulum, when adjusted to the appropriate length, gyrates in a negative direction above a cavity and will continue to do so if you move forward slowly and without checking. If you stop abruptly

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the gyrations immediately become positive, and then again become negative, and so on. If you get only negative movements or stopping abruptly you can conclude that your cavity has been stopped up and is full of earth. These remarks regarding natural cavities are equally applicable to artificial ones—wells, galleries, rooms.

The 'sample' used is merely a corked glass tube. If we are not mistaken such a one was used by M. Viré, Director of the Laboratory of Subterranean Biology at the Muséum, whilst carrying out investigations during the war (cf. p. 17). We have used electric light bulbs, little bottles and tennis balls for this purpose.

Although all the experiments which we have just described have only a scientific significance they lead to results of a very practical kind. Let us mention a few.

The farmer will be able to find places in his land where impermeable clay can be found near the surface which could be used for lining a pond.

The architect will be able to discover pockets of sand, made ground, and anything in the nature of filling.

The quarry contractor could with great advantage make use of our methods for numerous purposes connected with his profession. The rod and the pendulum lend themselves more readily to his needs in that he works from the surface downwards and can at once easily verify his interpretations of their movements.

The archaeologist will discover underground

buildings, tombs, ancient metal tools; will trace foundations, and will easily reconstruct the ground-plan of structures which have perished and disappeared.

The officer, too, will be able to locate dug-outs and galleries; he could apply the method of prospecting at a distance to motor vehicles in motion, notably to aeroplanes: a general direction is first found by pivoting on a fixed point with the rod, then with the arm held out as a feeler and a bit of steel as a 'sample', the exact position can be fixed.

The following experiment is as curious as it is easy: you hear an aeroplane, look for it with the hand held out, whilst watching your pendulum; when the latter passes from oscillation to gyration raise your head quickly and you will see the aeroplane in prolongation of your arm. You can also use the metallic stick-pointer as a feeler.[1]

PROSPECTING FOR MINERALS

Now we are going to consider prospecting for minerals, a subject of peculiar interest to engineers.

Ores are found either as surface deposits such as alluvial beds (gold bearing, tin bearing, etc.), or in beds like those for coal and some kinds of iron ore, or in masses, or in veins.

About the first two cases we have nothing to say beyond what we have already said. The other two, however, require some further explanation. A vein

[1] A kind of metal walking-stick invented by Friar Padey, used by him for prospecting at a distance.

is a fissure in the soil in which materials have been deposited often of a varied nature. The sides of the veins are called 'walls' and they are lined with argillaceous matter called 'gouge'. Then comes the 'gangue', composed of quartz, calcite, fluorspar,

Fig. 11.—Using the Pendulum, made of a bag of ore

dolomite, etc. The overhanging side of the surrounding rock is called the 'hanging wall' and the underside the 'footwall'. The thickness of the vein is often termed the 'strength'.

The veins that exhibit a concretionary filling generally lie vertical or nearly so. Their thickness

is very variable, and one can sometimes follow them for kilometres.

They often form a veritable network, crossing and recrossing each other. The ores in these veins are frequently sulphides—namely galena, blende, and iron and copper pyrites.

The masses or massive deposits are ore bodies filled with mineral that has crystallised out from volcanic rocks when they solidified ; sometimes these ores are found in the form of veins and sometimes as lenticular or lens-shaped deposits.

Whatever may be the nature of the deposit it has first to be discovered, for very often all you know is that you are in the kind of country where minerals are likely to be found. Very experienced prospectors can recognise the possible presence of ores by various surface indications, but it is not easy to copy them, it is better to resort at once to our methods.

Let us assume, for example, that you are looking for galena, and that there is reason to suppose that it can be found in the district. It would be a long job if you were to beat the whole countryside looking for a vein several feet wide, but luckily you have at your disposal the method of prospecting at a distance.

Take a pendulum made of a little bag containing ore, a thread and a little stick ; then adjust your pendulum (held in the right hand) over galena, which requires a short thread. Hold in the left hand another piece of ore, and, though this is not absolutely necessary, a stick of the Padey type, but with a copper stem. It would be an advantage, we

think, to follow Linden's advice, ancient though it be, and hold a piece of zinc in the hand along with the ore. Now explore the horizon with the left arm extended. If the pendulum gyrates you have found the general direction of the deposit : repeat the performance, working from another point, and you will be able to locate your deposit.

This operation is often successful when working from a considerable distance, especially in the case of deposits of coal.

Another method of prospecting at a distance is carried out with a strong magnet. You put it on a thin board with a bit of the ore between the poles. You must move the magnet about in a horizontal plane whilst oscillating the pendulum before it. When the pendulum gyrates, note the direction of the magnet, for it is that of a deposit of the ore.

Now use the method of the solar plane, taking the lateral angles to localise the position more exactly. It is interesting to measure these angles as they are an indication of the nature of the ore.

Having discovered your deposit, trace its perimeter.

Verify and check by means of the Ferran detector the meridian method as on page 43, and Mager's angle of azimuth. In short, use every means of check that you know of.

For detector, place on a thin board two pieces of galena as nearly of the same size as possible. When you are over a deposit it will be impossible to find between these two bits a point of oscillation if your pendulum began by gyrating whilst moving from one towards the other.

The angle of azimuth of galena is 90°. You find it by moving round any point in the deposit, having been careful not to make any movements of the pendulum or rod above this point. Otherwise you would find the four cardinal points (cf. pp. 44 and 90).

We must mention here the following method pointed out by M. Heyndrickx which should always be used in the identification of an object.

Your pendulum, adjusted and provided with a 'sample', has gyrated over an object ; draw back and it begins to oscillate ; at the end of two metres, say, it gyrates. Return on your steps. If it gyrates again before you have reached the object, you have a proof of an identity between the 'sample' and all or part of the object.

If the pendulum had gyrated over an object of a different kind from the 'sample', or even over the 'image' (cf. p. 94) of a body similar to the 'sample', you would not have obtained a gyration in returning to the point where the first gyration had occurred.

Remember that when you have obtained a result with the rod it is as well to release one of the forks, otherwise later results might be spoiled. This practice, like that of joining the hands after each operation of the pendulum, should be carefully observed. It represents a clear division between two operations and prevents one from encroaching on the other.

In this connection we might mention that certain very experienced dowsers, notably Friar Padey and

M. Alfred Mathieu, assert that the use of our apparatus is liable to produce a kind of storing up of influences in our nervous system which may bring on fatigue and even illness. In order to guard against this one should, so they advise, after every operation turn the rod round in an opposite direction to that of its previous movement ; to the same end it is as well to use pendulums of painted wood. . . . We have never experienced any of these ill effects, but it is possible that our immunity is due to our having always used pendulums of painted wood and that we always employ very light rods made of whalebone which react very readily.

VEGETABLES AND MINERALS

Let us return to our mineral deposit. Use every method of check at your disposal, amongst which should be included that carried out by means of plants.[1]

M. Charpentier mentions several plants found growing over various deposits in America. His list, as well as those drawn up by other scientists, could be completed with the help of our apparatus when studying the connection between vegetables and minerals. About this we will speak at greater length in the following chapter.

Use all your geological knowledge to ensure that you do not waste time by looking for a lode where it is geologically impossible to find one.

[1] Henri Charpentier : *Géologie appliquée*, p. 86. Paris, Dunod.

RADIO-ACTIVITY AND IMPREGNATIONS

We know of several strange instances in which our apparatus has given a clear indication of the presence of metals in places where there were none and could not possibly be any. This kind of failure, against which our readers should be forewarned, can be due to several causes.

The first is the radio-activity of certain soils. One has heard the old stories common in all countries about treasures hidden in feudal castles. In their support we are often told that such and such a local dowser has had his hazel rod ' broken' at a certain spot. Excavations have been made and nothing has been found. We have checked several of these stories on the spot and have invariably discovered the presence of radio-active soils, generally clays. The radio-activity can be verified either by a 'sample' of known radio-activity or by several metallic 'samples'. If you see that all, or nearly all, of them make the pendulum gyrate you are probably right in assuming that you have detected some radio-active substance.

A second cause is due to what is known as 'impregnation', which makes a sterile rock affect our apparatus in the same way as a rich ore. Some think that it is due to the effects of waves given out by ores somewhere in the neighbourhood. However that may be its effect is very slight and is easily detected.

VALUE OF A DEPOSIT

We now want to know whether the deposit is rich enough in ore to make it worth exploiting.

That is a question which has worried many a prospector, for the work of investigation is very onerous, and a specialist to carry out our analysis is not always easy to find.

Now we have at our disposal several methods for finding out the value of a deposit.

The first and quickest consists in investigating the zone of influence which refers to the object of our search.

Lower your pendulum in a vertical line to the level corresponding to that of the deposit, say, as far as the chest. Move forward without altering this level. It begins to gyrate almost immediately, giving us the zone following that of distance (which you have just traversed in the vertical direction) only a trifling length of several centimetres : your deposit is valueless. If, on the contrary, you find several metres in this zone you may suspect something good.

You should draw up for yourself a personal table of distances ; it will be of great use to you, but note that the extent of the zones is modified by the altitude.

The pendulum with adjustable weight can be used to estimate the richness of a deposit or the contents of an ore. A little cardboard or wicker basket holding a ' sample ' into which you can drop marbles one by one will serve the purpose.

We will mention again a practical method for discovering whether one has found a valuable deposit or a considerable stream of water. The system of breathing in gymnastics, with the deep expirations so excellent from the medical, hygienic and sporting points of view, is well known (*e.g.* A. E. Meignien, *La Rénovation de l'Hygiène*). If one gives out one of these deep expirations whilst the pendulum is gyrating, in presence of an insignificant deposit or stream, the gyrations will stop or even change direction ; but if the deposit is rich and the stream of some size the gyrations will continue.

We do not claim that you will attain an extraordinary degree of accuracy by these methods, but it is something to be able to say : ' Such and such a vein is really valuable, whilst another of which much was expected will soon be exhausted and there is nothing to be done in this neighbourhood.'

Only trouble about masses of considerable area and showing zones which promise good value. Remember the theory of earth currents : if the pendulum gyrates it is because your nervous system has been affected by waves derived from the collision of metallic masses and earth currents, and yet these masses separated from the operator by thick layers of earth have a certain importance. We not infrequently register radiations which correspond to a trifling variation of intensity, but distrust such evidence and note only that which shows an appreciable degree of intensity. In other words, we by no means advise beginners to go in for treasure hunting.

PROSPECTING ELECTRICALLY

There is a curious resemblance between prospecting with the pendulum and the rod, which we have just described, and the methods of electrical prospecting of which the best known is that of Schlumberger.[1]

With the Schlumberger instrument, consisting of a potentiometer with a free line and two impolarisable electrodes, it has been ascertained that certain deposits of ores produce electricity. The differences of potential obtained are in the neighbourhood of a few hundreds of millivolts. It has been possible also by eliminating the unproductive zones and by tracing curves of equal potential to discover areas of land suitable for exploitation.

The reader will easily recognise that these closed curves much resemble the perimeters we obtain with the rod and pendulum. Another process consists in sending a continuous current into the soil, and then studying with a potentiometer and a free wire the curves of equal potential and various resistances of the land traversed. This is what the pamphlet we have referred to says : 'A map of electric resistances is really a geological map in which the different strata instead of being defined by their lithological and palaeontological properties are represented by their electrical resistance. A map of this kind can be drawn for any given depth'.

Our readers can see that we are not alone in our preoccupation regarding the improvement of geolo-

[1] *La prospection électrique par les procédés Schlumberger, Société de Prospection Electrique*, Paris, 30 rue Fabert.

gical maps. However, as we cannot send currents into the earth we study the earth currents which are there already.

Prospecting by electricity is sometimes carried out over very extended areas. By this operation curves several kilometres in length can be picked up. It resembles in this respect our lengthy traverses with the pendulum.

We can, moreover, with a pendulum adjusted for electricity, pick up curves of equal potential.

One can but hope that these methods of prospecting by electricity will be constantly improved. As it is they are of great service in showing that electricity circulates in the subsoil, and that it is perfectly reasonable and practical to endeavour to make use of it for hydrological and geological purposes. Whether it be with a highly scientific instrument or with our modest apparatus (though one subordinate to the human body, the most perfect instrument in existence) it matters little ; the principles are the same as is the end in view.

Father Kircher, one of the most illustrious scientists of the seventeenth century, wanted an invention, an instrument 'delicate and sensitive', to check the results of the dowser of his day. His wish has without doubt been realised in the apparatus just invented by MM. Armand Viré and Hugues Roche.

'This apparatus', so M. Viré writes to us, 'is based on the principle in physics of revolving magnetic fields. It works like the receiver of "wireless" and is so arranged that it emits a noise in the presence of one particular substance, and that only

when its antenna is pointing in the exact direction of that substance. By a process of elimination any substance (water, metal, etc.) can eventually be found in the soil at a particular spot if it is present there. It has been of great service to us for detecting the hidden fissures in Lake Bouvante and for various other purposes.' (Cf. *l'Illustration*, April 7, 1925.)

The apparatus, which is called *Appareil Robivir*, is the property of *La Société Robivir*, established at Lyons (MM. Hugues Roche, Léon Bidreman and Armand Viré). It was invented by M. Hugues Roche and in it are incorporated several patents. It picks up and analyses the radiations emanating from various bodies, and so permits of their being identified and of their position in the earth's crust being accurately determined.

Unfortunately it is at present a source of genuine danger to the operator from the physiological point of view and the Robivir Company will not provide it to inquirers until certain laboratory experiments now being carried out have rendered it less dangerous.

As a result of these experiments, it is expected that it will be practicable to employ the instrument not only for finding water and deposits of minerals, but for the solution of certain physiological and medical problems of extreme interest.

CHAPTER VI

VEGETABLES

IF you operate over a plant with the rod and pendulum, as you did over an electric current, you will obtain similar movements, but there will be four zones instead of three.

The first zone will, as in previous cases, refer to distance, the second to quantity, the third to quality, and the fourth, which is a new one, probably refers to the circulation of the sap.

The study of vegetables has induced us to form certain conclusions alike curious and practical. First of all we find that all edible vegetables give as a rule very few sets of gyrations—two or three, representing the qualitative or characteristic series. When you find longer series, say six or seven movements, be on your guard, for you are dealing with poisonous substances. This discovery, which has very important results, may seem at first somewhat extraordinary. However, we will see in the following chapter that the stomach gives a serial figure of six. Perhaps we have here a question of harmony, of syntonization, but we leave this problem to be elucidated by others with a wider knowledge of biology.

PLANTS AND SOILS

Another very interesting discovery is that of the connection existing between a plant and the land

where it is growing. Your pendulum gyrates in the same direction, a positive one, when you hold it first over a vigorous plant and then over the surrounding ground. If, on the other hand, you compare a plant or seeds with soil unsuitable for its growth, the pendulum, which will have gyrated over the plant in a positive direction, will gyrate in a negative direction over the soil. We first noticed this when operating at a trenched boundary between a peaty marsh and some excellent pasture land. The pronounced difference in movement caused by the herbage and the marshland was very striking.

Farmers often want to know why such and such a plant will not grow in such and such a soil. Let them carry out the experiment just mentioned ; or, better, let them do it before sowing and, as seed is very dear nowadays, they will be saved much useless expense.

FOREST AND FRUIT TREES

Here is another useful experiment. Hold out the first finger, as a pointer, quite close to a tree and the pendulum will gyrate. Move slowly round the tree and at a certain point the pendulum will pass from gyration to oscillation : this means that you are confronted by a diseased or dead part of the tree. Do the same with the rod ; move round the tree, facing it, and the rod will lift opposite a part in bad condition. Without enlarging on the subject it is easy to see that this simple procedure may be of great value to all those concerned with the care of forest trees.

When you are making an orchard or plantation you can distinguish very easily by means of the pendulum or rod vigorous plants from those which are not so. If you want to work quickly take the zone of influence in a vertical direction. Place your young tree on the ground, the trunk parallel to it ; hold a graduated ruler against it vertically with the left hand, then with the right hand hold the gyrating pendulum as near as possible to the tree. Measure the zone of influence on your ruler : assume it to be 50 centimetres ; you will probably find it will be different for a good number of the young trees and will make your choice accordingly.

Plants give rise to several amusing little experiments which are, moreover, excellent from the point of view of training. Take a leaf or flower by way of 'sample' from a clump, or, better, get someone else to take it, and try to find the plant from which it was plucked by the method of the solar plane or by using the arm as a pointer.

Apply the method of the solar plane to plants using a leaf as a 'sample', you will find the reactions to be different according as the plant is between the sun and you or on your other side. In the first case, to obtain a movement of the rod or pendulum, you must have as 'sample' a leaf from the plant itself. In the second case a leaf of another plant of the same kind will suffice. In the first case there is identity, in the second there is only similarity. From this interesting conclusions from the biological point of view can be drawn.

PLANTS AND MINERALS

Curious, too, is the study of the relations between vegetables and minerals.

As early as the eighteenth century Linden in his *Three Letters on Mining and Smelting*, dated from Holywell, Flint, in Wales, and addressed to Lord Halifax, had written : 'No Naturalist can deny the near Analogy or Affinity there is betwixt Minerals and Vegetables'.

Now, in support of this theory, if you walk in a wood where there are hazel trees, your pendulum with a 'sample' of gold will deviate strongly in their direction. It is probably from this fact that the very ancient belief arose that the freshly cut hazel rod can help to the discovery of hidden treasure. But in legends a malicious devil invariably intervenes, who, at the last moment, deprives the poor dowser of the fruit of his efforts.[1]

The idea underlying the legend about the hazel recurs in the relation of other species of trees with metals : for example, of the lime with silver, the beech with copper, the oak with iron, etc.

The serial figures of woods are, moreover, the same as those of the corresponding metals.

Before we made these observations, we often wondered whence came certain radiations of very clear metallic character, but now we have no doubt as to their origin, and can understand how dowsers have often been deceived by them.

[1] 'The Folklore of Dowsing,' Theodore Besterman, *Folklore*, June 1926 : London, Glaisher.

What then is the cause of this remarkable relationship? Is it due to a similar molecular disposition? Could it come from the presence of infinitisimal particles of metals? The districts where these phenomena have been observed were formerly covered by very ancient seas which may have stirred up and then deposited minute particles derived from the disaggregation of metalliferous rocks.

Here again is one of those questions to which it is difficult at the present day to give a precise reply. Happily, in this case as in many others, the lack of a definite theory is no bar to a useful and practical application of observed results.

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CHAPTER VII

BIOLOGY AND MEDICINE

THE use of the rod and pendulum as applied to biology and medicine is very recent, at least we think so, for we have found no mention of it in our historical researches.

Nowadays, however, various well-known dowsers, such as Abbés Bouly and Mermet, Friar Padey, Professor Bosset, etc., are much occupied with it, following each his own particular method.

At the same time a group of doctors, headed by Dr. Jules Regnault of Toulon, Director of La Côte d'Azur Médicale, possessing a strong spirit of initiative, have resumed the experiments of Abrams, the late celebrated American doctor.[1]

This method consists essentially in diagnosing diseases and undertaking their cure by means of an instrument in the nature of a wireless receiver. We must also mention the Société de Biodynamique, lately founded by Dr. Regnault with the object of studying all these questions, which has already published some interesting works.

In what follows we are relying on the authority of others rather than on our own experience, as the matters discussed have fallen much less within our scope than what precedes.

[1] *Les Méthodes d'Abrams*, by Dr. J. Regnault ; Paris, Maloine, 1927.

Let us then relate what we know of the dowsers we have just mentioned.

BOULY'S METHOD

Abbé Bouly, for we will begin with him, one day had the idea of applying his method of the solar plane to the investigation of microbes. Entering a laboratory he tried his rod over broth cultures of bacteria and found that it lifted. Shortly afterwards, assisted by a doctor, he worked in hospitals with broth cultures as 'samples' and began his investigation of bacterial diseases.

Pursuing this method he verifies the presence of a microbe similar to the 'sample' in the body of the patient. He then investigates its nature by studying its angles, as in the case of an ore.

In order to determine the locality of a disease the point of the rod is moved all round the body ; when in front of the seat of disease it is, as it were, thrown out of tune and lifts.

Abbé Bouly, be it said, does not wish to pose as a healer and only works with a doctor—a very wise precaution ; even in the case of animals he demands a veterinary surgeon. On p. 16 we gave some examples of his procedure, and we mentioned a case in which he tried to discover the remedy for an illness which had been diagnosed.

REGNAULT'S METHOD

This question of 'tune,' so far as it concerns the subject of remedies and their possible discovery by

means of a wave-detecting instrument, had already been studied by Abrams. As Dr. J. Regnault says in one of his articles on electronic reactions : 'Abrams has found out that the energy of various products, that the action of certain vibrations (colours, sounds, rhythmic oscillations of electro-magnetic fields, etc.) neutralise abnormal vibrations, and particularly those which are peculiar to various well-known complaints. Thence has arisen a new method which consists in determining the abnormal vibrating periods of a patient and in re-establishing the normal dynamism while suppressing the pathological vibrations by the use of suitable agents. Whether these agents are included in the present classifications of bacteriology, of serotherapy, of chemistry or of physics, it is, in reality always a question of physical action ; the agency must be either polaritherapy reinforcing the dynamism of the injured tissue or neutralising the pathological influence, or else interference and resonance.'

We may mention here that whilst a large part of the very numerous apparatus constructed by Abrams and his successors are of the wireless type, others, notably the apparatus of Regnault and Larvaron, are of a mixed type : that is to say, introduce an electro-magnetic mechanism between the operator with the pendulum and his subject ; the object of this is to obtain a degree of accuracy in measurements and calculations which cannot be expected with the very simple outfit which we have described.

The idea of a complement of the rod and the pendulum is by no means new. Long ago, in the time of Baron de Beausoleil, we read of a certain mineral compass ; we are not told much about it, but it seems to have been an accessory of the rod.

Fifty years ago Abbé Carrié fastened to his rod a sort of picture provided with a pointer. Others have copied it. The apparatus of Abbé Ferran, which we have described in its simplest form, is arranged to be able to measure almost to a fraction of a millimetre or milligramme.

REMEDIES—SAFE AND DANGEROUS FOODS

Let us return to the question of remedies which started with the experiment of Abbé Bouly. If the reader will refer to what we have said about plants and soils, p. 114, he will not be surprised that there should be an analogous phenomenon of concord and discord between an organ and a remedy or nutritive substance.

Note that if it is desired to pick up the radiations of an organ—stomach, lungs, for example—the first finger of the left hand must be held very near, the pendulum being held in the right hand.

Arteries must be carefully avoided, their presence is easily felt, for the serial figure for circulation of the blood is 30, whilst that of the lungs is only six, though even that is not given by diseased lungs. The serial figures of the organ and of the proposed remedy can be compared. Thus it can be understood that a pain in the stomach (of which the

maximum figure is six) is not to be cured by aspirin, which has a serial figure of ten.

Do you want to know what kind of food suits you and what does not? Point at the food in question with the finger as antenna, the pendulum gyrates as soon as it is adjusted : now hold the pendulum first over the food and then over your left hand. Three things may happen : the pendulum may continue to gyrate in the same direction as before, which shows that the food or remedy is good for you : the pendulum may begin to oscillate, showing that the food is neutral ; the pendulum may begin to gyrate in the opposite direction, which shows that the food is bad.

If you suspect auto-suggestion, work with the eyes closed, whilst an assistant brings the food. If you succeed in carrying out this experiment on yourself all the more will you succeed on others.

Similarly, the hand or that of another person can be compared with coloured ribbons or squares of paper. If the pendulum gyrates in the same direction over the hand and over black, a perfect state of health is indicated ; violet is an indication of anaemia ; green, of liver or stomach trouble ; yellow, blue, red, of other illnesses.[1]

These experiments which take us so far from the beaten track are merely an application of the general laws of harmony. Our limited personal knowledge of this subject does not allow us to go any further. Others, with an authority which we lack, will confirm or confound our statements.

[1] For experiments with colours an entirely black pendulum is required.

MERMET'S METHOD

Abbé Mermet uses the pendulum in his diagnoses with the first finger as a movable pointer or antenna. The pendulum gyrates as soon as the first finger is confronted by healthy organs ; an abnormal condition makes it oscillate. At this point the special talent of the operator comes in ; in the case of Abbé Mermet it is very great indeed and is reinforced by profound technical knowledge.

He can estimate the depth of a lesion in millimetres, working out in accordance with scales which are special to himself everything which may prove of interest in connection with the organ under observation. If the second part of this method, *i.e.* the calculation, is not within reach of everyone the first is easily applied ; and surely to have discovered whether any particular organ is in good order or needs to be seriously examined is an achievement of some importance.

PADEY'S METHOD

Friar Padey also has for the last few years practised an interesting method of medical research. With his patient lying with his head toward the sun, he will, whilst moving from his feet towards his head, discover three lines of influence on the right and as many on the left. The lines on the right begin from the waist. The first refers to the left lung, the second to the blood and the third to the heart. On the left side about the level of the feet there is the line of the nerves, that of the right lung and that of the mental condition.

The same lines are found on the man standing upright, and, in addition, in front of the breast a line perpendicular to the others which refers in a general way to the physical vigour.

These lines are studied either by measuring their lengths, *i.e.* the distance between the first and final gyration, or by counting the movements of the rod and of the pendulum. The distance between the lines, which is variable, must also be calculated.

As Friar Padey wisely says : 'To arrive at the radial area peculiar to each disease it would be necessary to carry out methodically in hospitals more experiments than we have found possible'.

BOSSET'S METHOD

M. Bosset, Professor at the University of Lausanne,[1] has carried out valuable biological studies with the help of coloured pendulums, notably on fowls in a chicken farm.

The pendulum enables him to establish what he calls the biological entity of a living being. This entity depends on three indications which are determined in the following order : vitality, fecundity and vigour. M. Bosset evaluates each of these indications by the number of oscillations of the pendulum.[2] The number is inversely proportional

[1] *Essai de théorie du pendule*, by Professor E. Bosset ; Paris, Durville, 1926.

[2] M. Bosset, whom we have seen at work, often uses the word 'stroke' (*battement*) instead of 'oscillation'. The pendulum is given an initial or a repeated impulse ; it is the change of movement which marks the end of the set. For example, the oscillation may incline to the left thirty times in succession, but the thirty-first may incline markedly to the right, denoting the end of one set.

to the importance of the result so far as concerns vitality ; in other words, a person whose vitality is strong will give two or three oscillations, sixteen would denote sterility, at the moment of death the number might reach 400.

On the other hand, for fecundity and vigour, the number of oscillations is proportional to the importance of the result.

The reader will compare the biological entity and its three indications with our zone of quantity or power and its three subdivisions for electricity, of tension, intensity and resistance.

We have ascertained that lengths corresponding to each of the three characteristics of a vegetable or an animal can be measured on the ground ; vitality corresponding to tension, fecundity to intensity and vigour to resistance ; the measurements, whether taken in distances or in oscillations, appear to agree perfectly.

The extreme importance of M. Bosset's discovery from the point of view of breeding by selection can well be realised. It is obvious that with properly made tables for the three important qualities of vitality, fecundity and vigour, very interesting results might be reached in the direction of racial purification and improvement.

M. Bosset has also investigated the well-known problem of the sex of eggs. Many people who have never heard of the dowser's pendulum know perfectly well that if a ring is fastened to the end of a string, the ring will gyrate over an egg in a clockwise direction if the egg would produce a hen and

in the opposite direction for a cock. Unfortunately, numerous errors have occurred in the application of this simple rule. M. Bosset has improved on this time-honoured method. He uses two pendulums, one black and the other white, the black is for males, though red or green would do as well. These three colours are of paramagnetic quality ; white, blue and yellow, on the contrary, are diamagnetic and are used for discovering females. The pendulum need only be a black one inside a small white bag. If the egg does not affect any of the pendulums it is sterile.[1]

M. Bosset suggests that there is a medical application of his method. The indication of vitality admits of the effect of any particular treatment being followed day by day, and, similarly, the indication of vigour affords a basis for the drawing of most instructive curves, rather like the curves of fever.

And here we come to an end of our study of the methods employed by dowsers in biological investigation. The advice we give our readers is to assimilate these different methods and fuse them into one. We cannot have too many ways of checking and verifying any result we may obtain.

In any case we do not think that the explanations we have just given can appear difficult or complicated. It is very often the simplicity of the method employed in achieving an important result which causes mistrust in the efficacy of that method.

[1] Verification of the origin of these movements is required, it is possible that they are due to the mineralogical elements in the egg—phosphorous, iron and lime.

We have no doubt that this very simplicity will induce people with scientific training to try experiments, and then all the methods described will become well known and generally employed.

CONCLUSION

RETURNING to our starting point we see that this study has been prompted by an examination of a strange instrument, the rod, the origin of which is lost in the mists of time. It had its place in the magical rites of the most remote antiquity, and such is the atmosphere of mystery with which it has been surrounded that even in our own time learned and distinguished men have sought to attribute its phenomena to such powers as are possessed by fakirs and mediums.

We consider that there is nothing supernormal in the movements of the rod and pendulum, and that they can be explained by well-known properties of electricity and electromagnetic waves. We have based our theory on a series of ten experiments, our object being not only to describe the phenomena but to explain the best way of carrying them out and of profiting by them.

The great progress made by operators with the rod and pendulum is of very recent date. In reality it dates from the day when the principles on which wireless telegraphy is based were first applied to a practice hitherto regarded as childish and superstitious. Theory, as in all scientific discoveries, has guided research, and the harvest seems already abundant.

Certain apparatus are capable of picking up waves

coming from tremendous distances, so why should not the sense of touch be capable of extension? and why should not amplifiers be used for this as for the other senses? Why should there be no equivalent to the telescope and microscope?

Once started on this road investigators have seen a steady accumulation of results, primarily in connection with the traditional practice of water finding, which has been improved and developed, and with prospecting for mines, an art which had been abandoned but has now been resumed with success.

Mineralogy has added our modest pendulum to its list of scientific and expensive instruments with profit to itself, whilst medicine and biology have at their disposal a diagnostic weapon as convenient as it is economical.

It is obviously in the interest of all engineers, architects, farmers, doctors, to learn the use of the rod and pendulum, a task by no means difficult, requiring a modicum of attention and perseverance.

Perhaps the most remarkable result of this study —and one by which the 'magic rod' has earned its old name—is that it compels all those who take it up to an intellectual labour which they would not otherwise have embarked on. To learn the technique of our art is not enough, in fact it is a very little thing; the important requirement is a thorough knowledge of geology and its various branches, and some acquaintance with electricity and chemistry.

As for biology and medicine, their sphere is so

extended that we strongly advise those who have not already specialised in these subjects to have nothing to do with them.

The results obtained to-day have been considerable ; to-morrow they will be even greater, and will furnish an important record of useful services carried out.

We will then gratefully remember that those who have been our benefactors, those who have been to the fore in their confident reliance on the splendid discovery of Branly, those who have given us the methods which all are free to copy, have been for the most part, the humble country clergymen of France.

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